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THE WILD TURKEY AND ITS DOMESTICATION.

BY HON. J. D. CATON.

I HAVE been well acquainted with the wild turkey (*Meleagris gallopavo*) of this country for over forty years, and have had good opportunities of studying it in its wild state, and for more than ten years past I have raised it in domestication, having had sometimes over ninety in my grounds at one time, and having raised more than sixty in a single year. Some observations on their habits and domestication may not be uninteresting.

My original stock was procured from eggs taken from the nest of the wild hen, in the woods, and raised under the common hen, and it has been twice replenished in the same way, on one occasion with seven individuals. The purity of the stock, therefore, cannot be questioned; but still more conclusive evidence was in the markings, so fully and accurately described by Audubon, Baird, and others. I know of no bird or animal where the markings are more constant or reliable than on the wild turkey; even to the number of bars on a given quill of the wing, for instance, which may be relied upon to identify it.

The young bird from the egg of the wild turkey, when brought up in close intimacy with the human family, becomes very tame, and when grown the males become vicious and attack children and even grown persons. I once had eight hatched out by a hen, and gave them in charge to the wife of a tenant, with stimulating promises if she raised them, and she did it nicely. They were allowed to go into the house, to fly upon the table, and to eat with the children. Until they were grown, any member of the family could go up to one and pick it up at any time, but they were afraid of strangers, and if anything excited their suspicion they would take wing and be off like a flock of quails.

At first I procured but a single pair of wild turkeys. The sea-

son they were a year old neither showed the least inclination to breed. The male was not heard to gobble, the wattles upon the neck did not turn red, and he was not observed to *strut*, as is usual with the male turkey in the breeding season. The next year he made up for all this, and the female also well repaid me for waiting. All the others I have had have bred freely when a year old.

I am now wintering the eleventh generation of the domesticated wild turkey, though the progenitors of a portion of my flock were introduced more recently. They generally occupy the South Park, about forty acres in extent, mostly covered with second-growth trees of about twenty-five years' standing, with a considerable number of old oak trees interspersed. In the park are ravines with good hiding-places. It is heavily set with blue-grass and some white clover.

The effect of domestication has been very marked. They have not deteriorated in size or in reproductive powers. They have always been healthy excepting in the summer of 1869, when they were afflicted with some disease from which about three quarters of the flock died. They have changed in form and in the length of the legs. The body is shorter and more robust, and its position is more horizontal; but most especially have they varied in color. These changes I have constantly watched. In the first and even the second generation but little change was observed. After that the tips of the tail feathers and of the tail coverts began to lose the soft, rich chestnut brown so conspicuous on the wild turkey of the woods, and to degenerate to a lighter shade; the beautiful, changeable purple tints on the neck and breast became marked with a greenish shade; the bristles on the naked portions about the head became more sparse or altogether disappeared; the blue about the head and the purple of the wattles were replaced by the bright red observed on the tame turkey-cock; the beautiful pinkish-red of the legs became dull or changed to brown. The next year, or when the bird was in its second year's growth, say in the third generation, these marks of degeneration would on most of the specimens, especially of the cocks, disappear, and the plumage would show the thorough-bred wild turkey. Each succeeding generation shows these changes to be more pronounced, but each year as the bird gets older the shades of color of the wild parent become more distinct. The change of form keeps pace with the change of color, which is much more manifest on the hen than on the cock. I have hens now three or

four years old with brown legs, though still showing the pink shade, and on whose feathers the white has very considerably replaced the cinnamon shades. In fact I have many specimens that would readily pass for the bronze domestic turkey, even in the view of an expert. I am satisfied that without a fresh infusion of wild blood, in the course of fifteen or twenty years more but few individuals would show the distinctive marks of the wild turkey to any considerable extent, and the whole would be pronounced the bronze domestic turkey. This change is much more manifest in some individuals than in others, still it is very marked in all. I have met with several farmers in the West who have domesticated the wild turkey and whose experiences correspond with my own, but they are not writing men, though frequently pretty good observers. The truth is that those having the most facts on this particular subject do not appreciate their importance, and the observations they have made are never known to the scientists who are most capable of weighing and comparing them, and it is possible that these have fallen into errors for the want of full data.

The habits of the wild turkey are not as rapidly changed by domestication as its form and coloring; still they undergo a change as well. The wild cock-turkey by the time he is five months old seeks a perch well up in the largest trees in his range, and as he grows older he is constantly inclined to seek a higher perch, till he is frequently found at the very apex of the tallest tree. The largest turkey I ever killed sat at the extreme top of a very tall tree, which enabled me to see him against the background of the clear eastern sky as the day was breaking, while all below was profound darkness, and so I had plenty of time to approach behind another large tree with the most deliberate caution to within range, and there I had to wait a considerable time before I could see the sights of the rifle. He was already alarmed and stood as straight as a penguin, which is the constant habit of the bird when his suspicions are awakened. Fearing he would leave I fired before I could tell whether his back or his breast was towards me. When a twenty-four pound turkey falls from so great a height, and thrashing through the branches of the tree strikes the ground with a great crash, it is music to the ear of him who can claim the prize. A companion once killed a very large cock on the top of a very large tree, under which we had made our camp fire, where he had sat for hours undisturbed by the noise and bustle of our camp. As we had approached

the place without caution, — laughing, talking, and perhaps singing, — he knew he was undiscovered and not likely to be looked for there, and so felt no apprehension, and it was only by an accident that his presence was found out. These incidents tell us of the habits of the bird.

This disposition, especially of the cock, to seek a high perch is scarcely impaired by domestication in the second and third generations, but after that they seem less ambitious for high places, and it appears to grow less and less in succeeding generations, till they come down to about the level of the domestic turkey.

The wild and suspicious timidity so characteristic of the wild turkey is eradicated very slowly. When back in the park foraging they seem suspicious even of the one who daily feeds them, and make off when they see him approaching; but upon their feeding grounds most of them come to pick up the corn even within a few feet of strangers. Let any cause of alarm, however, occur there and they take fright at once. Those only two or three generations from the woods will take wing, while the others will run like race-horses. This wildness, however, diminishes with each succeeding generation.

The eggs of the wild turkey vary much in coloring and somewhat in form, but in general are so like those of the tame turkey, that no one can select one from the other. The ground color is white, over which are scattered reddish-brown specks. These differ in shades of color but much more in numbers. I have seen some on which scarcely any specks could be detected, while others were profusely covered with specks, all laid by the same hen in the same nest. The turkey eggs are more pointed than those of the goose or the barn-yard fowl, and are much smaller in proportion to the size of the bird.

When the wild turkey in the forest voluntarily leaves her nest, she always covers it with leaves sufficient to hide the eggs and all evidence of the nest. This is less carefully done by the first descendants of the wild hen, and each succeeding generation becomes more careless in this regard, till now more than half the nests we find are not covered at all, and none are covered with the care always manifest in the wild state.

This wildness seems the most constant with the hen in the breeding season. When the hens are about to commence laying, they seem to relapse to their native wildness and seek the seclusion of the North and East parks, or if their wings are not clipped they may escape from the park to the neighboring forest and

there rear their young. After these get as large as quails, or perhaps larger, they generally bring them home, or with a little care they may be driven home. Although the young birds are as wild as possible at first, after they have tasted corn a few times and find it is furnished by a man on foot or from a buggy, they lose all fear and become importunate, while the mother hen may still hang back suspiciously. I have often, when driving through the park, had the half-grown birds fly into the covered rock-away for corn, for they soon learned there was always corn there for them.

The cocks after a few generations never get as wild as the hens do at the breeding season, but stay contentedly in the South Park, and nearly always keep together. They may amount to fifteen or twenty in number. If the nest of a hen is broken up she immediately seeks the cocks and then returns to seclusion, and generally she will even make a third nest if the second is destroyed. I have never seen the cocks fight for the hens, although there may be a dozen of them of equal age and size. These seem to have no leader and to have no master, and rarely have disputes except when being fed. Then one is very apt to make a pass at another, which is most likely returned, when two or three others will join in the fray, appearing quite indifferent as to which they hit. After a fracas of two or three minutes they all seem to remember that it is supper time, but on looking about they discover that the hens and the youngsters have taken it all. Whenever the new broods are brought home in the fall, they must be attacked by the home flock, — the old cocks, the barren hens, and the young ones, which have been initiated through similar tribulations. The mother hen is treated as a stranger just as much as if she had never been there before. A single day, however, is sufficient to establish friendly relations, when the new-comers are admitted to the family circle on cordial terms.

I have never noticed any disposition of the old cocks to interfere with a setting hen, or her nest, or her young brood, only when a half-grown flock comes home they are simply treated as strangers, as already stated.

The pinion of a wing has been removed from many of the old hens, and if the latter are kept in the South Park where the cocks run, and which is really the home of all, they nest there, frequently making the nest by a slight excavation in the open grass-plot, away from any protecting object, and one is astonished at the difficulty of finding the hen setting there, although the place

be described where to look. Experience has proved that I do not get nearly as many young from those which are obliged to nest in the South Park as from those which retire to complete seclusion and are never seen or heard of, except by chance, till their chicks are as large as quails.

My observations accord with those of Audubon as to the riendly relations existing between the brood hen-turkeys. It s not uncommon for two or three hens to lay in the same nest, and then set upon the eggs and raise the young together, though this I always look upon as a misfortune, for most likely they will not commence laying together, so that after one commences setting the other will keep on laying for a week or two before she commences setting. As neither will remain a day after the first chick is hatched, of course all the late-laid eggs are lost, unless they are taken out and put under a hen, when they generally hatch out, although they may have lain a day in the nest after they were deserted, if the weather is warm. The hen is often a very pertinacious setter, remaining upon the nest a week or more after all the eggs have been removed. I once found a hen setting upon an empty nest on a declivity of a ravine, and found the eggs scattered about, some very near the foot of the hill, and quite cold, — the mischief of a peacock. Those not broken were returned to the nest. When approached the hen ran away, but soon returned to the nest and hatched out every one of the eggs and raised the birds. The hen, so far as I have observed, never remains upon the nest longer than the morning after the first bird is hatched, though there may be no more than one bird out, leaving all the remaining eggs to their fate. When a day old the chick can follow the hen, though it may tumble down on every foot of the ground it runs over. When two or three days old it will follow the hen with astonishing vigor, and will trail through the grass in a cold rain storm without injury, when similar exposure would have been fatal to the domestic turkey. I have had repeated opportunities to test this, and I do not believe that I ever lost a young bird by reason of its getting wet. Even the hybrids [1] are capable of enduring exposure, when but a few days old, from which we should despair of the domestic bird.

When two young broods meet in the woods neither hen will show hostility to the young of the other, and they will generally separate after a little social intercourse; but sometimes they will

[1] I use this term not in its strict sense, but for convenience.

amalgamate and ever after range together, when each hen will take the same care of all as she did of her own. I have often seen three hens thus together leading around a large flock of young birds, the three broods being manifestly of unequal ages as they were of sizes.

The flesh of the young wild turkey is as white as that of the tame turkey till mid winter. After that it begins to show a darker shade, and when a year old the change of color is very appreciable, and this darker shade deepens till the bird is several years old. All of this is entirely lost by domestication. I have never killed a bird from an egg taken from the wild hen's nest in the woods, for I could not afford to do this, but I have had on my table many of the next generation, all the way from eight months to two or three years old, raised in my grounds. In every instance the flesh was as white as that of the domestic turkey. The change of food and the less active habits produce this change of color of the flesh of the wild turkey.

Turkeys consume more herbaceous food than is generally supposed. In the spring, when fresh vegetation shoots forth, they subsist almost entirely upon it, showing less anxiety for corn than at any other season. Blue-grass and clover they seem to prefer, and on these they graze almost as freely as the geese. Later, when insects appear, they manifest their carnivorous appetite and become constant and diligent foragers for them. They are not scavengers like the barn-yard fowl, but much prefer, if they do not confine themselves to, living animals. Still they by no means limit their selection to insects. I once saw a half-grown turkey acting very strangely, and stopped a little way off to notice his actions. I soon observed that he was in a contest with a snake about ten inches long. He would pick it up and throw it and again seize it as soon as it struck the ground. At length, after the snake seemed pretty well disabled he seized it by the head and began to swallow it. The part of the snake yet in sight thrashed vigorously around, sometimes winding itself around the head and neck of the bird. This was too much for the turkey, and he threw it up and went at it again to make it more quiet, and then another attempt was made to swallow it; but it was not till the third effort was made that success was achieved, and then the process occupied several minutes, the tail of the snake being all the time active till it finally disappeared.

This magnificent game bird was never a native of the Pacific coast. I have at various times sent in all about forty to Califor-

nia, in the hope that it may be acclimatized in the forests. Their numerous enemies have thus far prevented success in this direction, but they have done reasonably well in domestication, and Captain Rodgers, of the United States Coast Survey, has met with remarkable success in hybridizing them with the domestic bronze turkey. Last spring I sent some which were placed on Santa Clara Island, off Santa Barbara. They remained contentedly about the ranch building and, as I am informed, raised three broods of young which are doing well. As there is nothing on the island more dangerous to them than a very small species of fox, we may well hope that they will in a few years stock the whole island, which is many miles in extent. As the island is uninhabited except by the shepherds who tend the immense flocks of sheep there, they will soon revert to the wild state, when I have no doubt they will resume markings as constant as is observed in the wild bird here, but I shall be disappointed if the changed condition of life does not produce a change of color or in the shades of color, which would induce one unacquainted with their history to pronounce them specifically different from their wild ancestors here. Results will be watched with interest.

My experiments in crossing the wild with the tame have been eminently successful. These have been conducted at my farm in the country. I first sent up a cock and turned him out with a few domestic hens. They all raised good broods. The hybrids grew larger than either parent. The next year the hybrid hens, as the breeding time approached, manifested the wild disposition of their wild ancestor, but they had an artificial grove of ten acres a little distance from the buildings, which was set with a thick undergrowth, and here they nested. When they brought off the young broods, instead of keeping about the barns as their tame mothers did, they wandered off through the fields where they found an abundance of insects. There was no forest nearer than two miles, so I think none of them found their way to that. Some of them returned to the grove to roost at night, while others remained away. Pains were taken when they were met with in the fields to drive them to the barn and feed them with corn. This rarely had to be repeated, for they would come up themselves for their suppers. Some wandered away and never returned, but were afterwards recognized about the yards of neighbors perhaps miles away; in subsequent years they were much more easily kept in hand and probably few were lost, till now after seven years there is little trouble to keep them about the

place at night, although they wander off through the fields for a mile or more during the day, but they always get a ration of corn about sunset. Last fall the flock counted one hundred and ten, and was the finest I ever saw together. I have had turkeys on my table the past winter not eight months old that weighed seventeen pounds dressed, though some of the young hens did not exceed nine pounds. I have sent to the farm several thorough-bred cocks at different times, but as they were from my domesticated stock they did not seem to add much to the wildness of the birds.

My experiments establish, first, that the wild turkey may be domesticated and that each succeeding generation bred in domestication loses something of the wild disposition of its ancestors.

Second, that the wild turkey bred in domestication changes its form and the color of its plumage and of its legs, each succeeding generation degenerating more and more from those brilliant colors which are so constant on the wild turkey of the forest, so that it is simply a question of time — and indeed a very short time — when they will lose all of their native wildness and become clothed in all the varied colors of the common domestic turkey; in fact be like our domestic turkey, — yes, be our domestic turkey.

Third, that the wild turkey and the domestic turkey as freely interbreed as either does with its own variety, showing not the least sexual aversion always observed between animals of different species of the same genus, and that the hybrid progeny is as vigorous, as robust, and fertile as was either parent.

It must be already apparent that I, at least, have no doubt that our common domestic turkey is a direct descendant of the wild turkey of our forests, and that therefore there is no specific difference between them. If such marked changes in the wild turkey occur by only ten years of domestication, all directly tending to the form, habits, and colorings of the domestic turkey, — in all things which distinguish the domestic from the wild turkey, — what might we not expect from fifty or a hundred years of domestication? I know that the best ornithological authority at the present time declares them to be of a different species, but I submit that this is a question which should be reconsidered in the light of indisputable facts which were not admitted or established at the time such decision was made.

There has always been diffused among the domestic turkeys of the frontiers more or less of the blood of the wild turkey of the

neighboring forests, and as the wild turkey has been driven back by the settlement of the country, the domestic turkey has gradually lost the markings which told of the presence of the wild, though judicious breeding has preserved and rendered more or less constant some of this evidence in what is called the domestic bronze turkey; and the more these evidences are preserved in the bronze turkey, as the red leg and the tawny shade dashed upon the white terminals of the tail feathers and the tail coverts, the better should the stock be considered, because it is the more like its wild ancestor.

That the domestic turkey in its neighborhood may be descended from or largely interbred with the wild turkey of New Mexico, which in its wild state more resembles the common domestic turkey than our wild turkey does, may unquestionably be true, and it may be also true that the wild turkey there has a large infusion of the tame blood, for it is well known that not only our domestic turkey, but even our barn-yard fowls relapse to the wild state in a single generation when they are reared in the woods and entirely away from the influence of man, gradually assuming uniform and constant colorings. But I will not discuss the question whether the Mexican wild turkey is of a different species from ours or merely a variety of the same species, only with differences in color which have arisen from accidental causes, and certainly I will not question that the Mexican turkey is the parent of many domestic turkeys, but I cannot resist the conclusion that our wild turkey is the progenitor of our domestic turkey. Indeed, we know that this is so to a very large extent, from their constant interbreeding along our frontiers, and I never heard of any one who had wild blood in his flock who did not think he had as good domestic turkeys as any one else.

THE STUDY OF ZOÖLOGY IN GERMANY.

BY CHARLES SEDGWICK MINOT.

I. THE LABORATORIES.

HAVING had somewhat extended opportunities for seeing various laboratories in Germany, and for working in some of them, the writer became much impressed by the great advantages they offer; and as they are at once training-schools and the scene of active original research, it seems appropriate to begin by some account of them.

All the laboratories with which the author is acquainted are connected with universities which, unlike many of our colleges, are not mere high-schools, but are the centres of intellectual activity and the seats of the highest teaching. The distinguishing feature of them is their organization, which gives to original research the highest rewards, and makes everything else subordinate to investigation. Thus, when a student tries for his degree, he passes merely an oral examination, for though he may appear deficient as regards positive knowledge, yet if his thesis contains the results of original work and is judged good, the imperfections of his knowledge are disregarded, and the degree is duly conferred. Again, upon becoming a teacher he is obliged to present another original research, and the professors are, as a rule, selected according to their abilities and success as investigators. The consequence of this system, the same at all the twenty-one German universities, is that both instructors and students regard investigation as the proper scope of their industry. This general spirit makes itself felt in the zoölogical department as well as in every other.

The rigid adherence to this system has made the German universities the home of the highest science. Thus, while intercourse between *savants* is restricted in America and England mainly to accidental meetings and the gatherings of learned societies, the scientists of Germany come together to work for a common end, the maintenance of the university with which they are connected. In every respect science is furthered by the organization and spirit maintained in every German university. There are, of course, grave defects connected with the system, but these the author cannot enter into, not being qualified. These general remarks have been prefixed to indicate that which usually makes the deepest impression on the American student.

The zoölogical department belongs to the philosophical faculty, but the union of the various faculties is very close, and students belonging to one can and habitually do attend the lectures of other departments. Among the zoölogical students it is usual to go through a course of human anatomy and physiology along with the medical students; they are obliged to study two natural sciences besides zoölogy, and to be examined in all three in order to obtain their degrees. In some instances botany is one of the required studies, or when otherwise is usually chosen, and the third subject is commonly chemistry, physics, geology, or mineralogy. Thus it will be seen the students receive a broad scien-

tific training, rendered still more effectual because they voluntarily attend several extra courses.

The quality of the education in each branch depends mainly upon the character and the ability of the professor, and therefore we find the students passing from one university to another in order to attend the courses of some particular professor. This they can do the more readily because immatriculation at one university gives them the right to enter another upon merely presenting their certificates from the first. All the universities are so much alike that it is quite possible to break off from a course at the end of the semester and go elsewhere to complete it. In this way various masters of the same science influence the learners, and the one-sidedness of one teacher is counteracted by another. This seems to the writer an advantage which can hardly be overestimated.

After these brief general remarks we pass to the consideration of the zoölogical work, strictly speaking. First of all we notice the advantage of the secure basis upon which is built up the superstructure of special zoölogical knowledge, thus giving every student an initial advantage which we regret to say is rare in this country.

The professor of zoölogy delivers two regular courses of lectures every year, one semester on general zoölogy or comparative anatomy, and during the second another on special zoölogy, including classification. In the first course he expounds the fundamental characters of animals, their microscopic and comparative anatomy, embryology, physiology, and so forth. This, it will be seen at once, is a different plan from that usually followed in this country, where zoölogical instruction subordinates everything to classification. There can, we think, be no doubt which is the better way. Fortunately, the old system is slowly disappearing in America as well.

Besides the professor there are usually one or two *privatdocents* who, just beginning as instructors, take up some special branch of zoölogy and offer more detailed information than the professor can crowd into his general lectures.

But the main activity of the student is not found in the lecture room but in the laboratory: there he spends most of his time, and there he acquires his most valuable knowledge, learning to dissect and to use the microscope, and making the acquaintance of the principal forms of animal life. The professor and his assistants are constantly at hand to guide and suggest,

and from the very beginning the student is introduced to special memoirs and directed to the best general works. The laboratory is usually provided with a small collection of books, among which never fail to be Gegenbaur's Vergleichende Anatomie, Claus's Handbuch der Zoölogie, Kölliker's Histology and Embryology, and Bronn's Klassen und Ordnungen des Thierreichs. Besides these there are always a number of miscellaneous and more special works — perhaps two or three hundred — whose appearance is that of veterans in service.

The university library, usually very rich in old publications, but apt to lack many of the newer ones, is accessible to the students, though getting out a book involves usually great and, as the experience of our American libraries prove, unnecessary annoyance. There is generally no catalogue to which the students are allowed free access. Altogether, Americans sometimes justly feel provoked by the clumsiness of the arrangements in the libraries, — the usefulness of which certainly does not correspond to the number of volumes they contain, — but after all the books are there and can be got at. The writer has always found his professors exceedingly kind in lending books, and that is of great advantage, because, thanks to the admirable practice of interchanging scientific publications so extensively, all the leading men own separate reprints (*separat-abdrücke*) of a great many papers.

The laboratory is always connected with a museum, which, except at Berlin, Munich, or Leipzig, is small, having been created mainly to bring together an instructive collection, sufficient to exhibit the principal varieties of animal forms, and to supply the necessary anatomical preparations for illustrating the lectures and aiding the students. Besides this it is often attempted to keep up an abundant supply of specimens for dissection. The students are encouraged to collect living specimens for themselves, and to learn to recognize the typical forms of animals. The writer has often seen a professor bring in some strange creature and make the learners examine it, and try to determine its relationship for themselves.

Having looked at the conditions under which the learner is placed, we proceed to examine his work. We notice above all a want of system: each person is launched out by the instructor, but has afterward to guide himself as best he may, with occasional help or warning from his teachers. It strikes one as a rather slipshod manner of learning, but it is pretty sure to weed

out the inferior pupils, for only industrious and energetic ones can struggle on to the end. The woful lack of method would be more injurious than it is, were it not counteracted in every laboratory by the spirit of truth-seeking, which should always guide every original investigation, and by the rivalry among the students, and the high respect for zoölogical science constantly inculcated.

The first thing learnt is the distinction between physiology and morphology as the two great branches of zoölogy, and then most of the time is taken up with morphological work; consequently morphology comes to be viewed as the principal field of work for a scientific zoölogist. Classification, comparative anatomy, histology, and embryology are combined as one department, and the aim of the student becomes finally to make himself acquainted with the general principles of morphology, with the intention of ultimately taking up some special investigation. In America a class or an order are made a specialty, and we have carcinologists, herpetologists, ornithologists, etc., who attempt to study everything connected with the group they have chosen. In Germany some branch of morphology is taken up, thus the eye, or the nervous system, or the comparative anatomy of some division. In one country all the characters of one group are made a specialty; in the other more frequently a few characters are studied in many groups.

When the student has advanced far enough, he is encouraged to take up some special investigation with a view to writing his thesis to get his degree. The foundation having been broadly and well laid, he narrows his attention to a particular question and begins his original work. It is then that the professor becomes most ready to assist, and it is generally considered his most important function to teach how to make a research by carefully controlling and guiding the learner in his first research, examining his preparations and discussing his conclusions with him. This is admirably done by some professors, poorly by others, but all are interested in its being well done, because a fault in a thesis by a pupil from a laboratory discredits the professor who ought to have cared for its avoidance. Many graduating theses are valuable papers, often quoted as scientific authorities upon the subjects of which they treat. Their character generally shows the ability of the student pretty fairly, whether he be equal to difficult problems or only to simpler ones.

In Germany special knowledge is required on the part of the teachers; it is only in the United States that a professor has to teach zoölogy, botany, palæontology, and geology all at once. Accordingly there are often persons in the zoölogical laboratories who intend to become school-teachers, while the more brilliantly endowed aspire to university chairs. There are then two sorts of students, but though the aim of one is humbler, yet they too prize the degree of Doctor and work eagerly at their theses to secure the desired title. The opportunity is thus offered to each student to follow the course of several investigations.

The research is usually upon some point in comparative anatomy or in embryology, less frequently in histology, but it seldom has much to do with species, which are our greatest bugbear. New species are seldom discovered in Europe now, unless among the worms and protozoa, but anybody can find new species in the United States in almost any group of invertebrates. An industrious collector could probably easily obtain in one year in New England alone more than one thousand undescribed species of hexapod insects. In fact the trouble in Europe comes not from the species having no name, but from their having half a dozen different names. However, the forms are almost all known, and the work of zoölogists is much eased by it. It is to be hoped that we shall soon be equally well off.

In every laboratory microscopes are in continual use. The instruments are always simple and small, being intended to be kept on the work-table, and take up little room. The complicated machines, the delight of amateurs and the abhorrence of histologists, so much in vogue among us are never met with there. It is common enough to find Americans and Englishmen giving up their big home-made instruments and taking to the smaller and more convenient Continental microscopes, but the writer never knew any one to do the reverse. Simplicity, efficiency, and inexpensiveness make the German and French microscopes so superior to ours that it becomes a waste of money to purchase an American instrument.

Not only does the student keep his microscope constantly in use, but he is also continually making histological preparations of whatever good material he gets. He therefore becomes skilled and experienced, sees a great many different tissues, and is enabled afterwards to examine the cellular structure of any organ he wishes to study and control his results by comparisons with the tissues which he has already studied. Our next article will be

on the methods used for making histological and embryological preparations. The account here given applies, of course, to the best laboratories, but they do not all offer the same great advantages.

THE DISTRIBUTION OF VEGETATION IN PORTIONS OF NEVADA AND ARIZONA.

BY W. J. HOFFMAN, M. D.

THE flora of Nevada may be divided into four distinct classes, namely: —

I. The flora of the mountains.
II. The flora of the foot-hills.
III. The flora of the plains.
IV. The flora of the salt marshes.

In the lower two thirds of Nevada and the northwestern portion of Arizona, from latitude 41° 40′ N., at Bull Run Mountain, southward to latitude 35° 20′ N., we have a country composed of a series of plains and deserts surrounded by a net-work of mountain chains. The more northern valleys are composed of tolerably good soil, but as we proceed southward they become more and more sandy, and contain a greater amount of saline ingredients. There is every evidence that many of these basins were at one time inland seas, but owing to the rapid evaporation and absence of aqueous precipitation, they have in the greater number of instances become dry, leaving their solid ingredients as the soil of the deserts, as in Diamond Valley, Death Valley, etc., or there may still remain sufficient moisture to cause salt marshes, as Armagosa Desert and that at Silver Peak which covers an area of only about eight or nine hundred square miles of mud and salt. A great deal of the alkalinity of some regions is derived from the mountains. During the disintegration of feldspathic rocks, the soluble salts are slowly carried down to add to the sterility of the valleys. Rain seldom falls on the plains, but the more prominent peaks are subject to showers nearly every afternoon. Peaks whose altitude exceeds that of the timber-line are most frequently visited. The causes are, the air becoming heated on the deserts (as in Death Valley we recorded 120° in the shade at from two to half past three o'clock) rises towards the cooler summits of the mountains, when condensation of vapor terminates in precipitation, the heavy clouds charged with electricity hanging over the mountains for an hour or two, usually

disappearing before sunset. The rain seldom reaches the base, as the parched sandy soil absorbs it before it descends half-way down to the foot-hills, except in case of cloud-bursts when the water tears up a new channel and rushes out over the desert to sink at once in the soil. These storms do not affect the atmosphere of the plains perceptibly. Differences of wet and dry bulb readings show variations ranging from 5° to 45° F.

The flora of that portion of Arizona under consideration may likewise be classed under the same divisions, excepting that the fourth class gradually diminishes, giving place to that of the dry sandy deserts — which we will include with the third class — of the plains in Nevada.

The following table is arranged according to the latitudes, commencing at the northernmost point (Bull Run Mountain) and running south: —

Name.	Altitude above Sea Level.	Elevation of Timber Line.	Latitude.	Elevation of Nearest Plains.
Bull Run Mountain.......	8,450	8,300	41° 40′	5,800
Prospect Hill............	9,650	9,400	39° 30′	6,000
Belmont.................	12,000	9,700	38° 40′	7,000
Mt. Nagle...............	11,000	11,000 [1]	37° 46′	7,200
Mt. Macgruder...........	11,500	11,150	37° 40′	7,200
San Francisco Mountain..	13,500	{ 12,500 13,000 [2]	35° 19′	{ 6,500 6,800
Bill Williams Mountain...	10,030	[3]	35° 13′	6,500

Mr. J. M. Coulter,[4] in his report upon the flora of Colorado, etc., says "that there is a very regular increase in the elevation of the timber-line as the latitude decreases, subject, of course, to variations when in the neighborhood of high table-lands or seas." This not only holds true in that region between the Rocky Mountains and the Sierra Nevadas, but, in taking a view of the section from Bull Run to Mt. Macgruder in Nevada, and as far as Bill Williams Mountain in Arizona, we have a barometric profile upon which not only the timber-line follows that law, but likewise different genera of plants and trees. The level of the prairie at Bull Run is 5800 feet above the sea, while at Mt. Macgruder — the southernmost point of observation in Nevada — it has risen to 7200 feet. At Bull Run the timber-line, at an altitude of 8300 feet, terminates with the upper line of the belt

[1] The altitude of Mt. Nagle does not reach that of the timber-line.

[2] The timber-line on this mountain is irregular, approaching to within one thousand feet on the eastern side and five hundred feet on the western.

[3] Bill Williams Mountain does not reach the elevation of the timber-line.

[4] Prof. F. V. Hayden's Report, 1872, page 751.

of *Coniferæ*, while the lower line rests upon a belt (400 feet of the vertical section) of mountain mahogany (*Cerocarpus ledifolius*), which in turn gives place at 7000 feet to the belt of *Salicaceæ*. This group terminates irregularly at the beginning of the foot-hills, at an elevation of about 6200 feet. The foot-hills are chiefly covered with *Phlox*, *Lupinus*, and *Rosaceæ*, and the plain with "grease-wood" (*Sarcobatus vermiculatus*) and "sagebrush" (*Artemisia tridentata*), the former being greatly in excess, but is gradually replaced by the latter going southward. The lines of demarcation are frequently indistinct, owing to the mingling of species of one belt with the adjoining ones, but they are plain enough to obtain an average elevation which I shall adopt in these descriptions.

At Prospect Hill, the timber-line has risen to 9400 feet in altitude; the belt of mountain mahogany becomes narrower, giving place at 8000 feet to the *Salicaceæ*, which belt becomes broader and terminates below at an elevation of 7000 feet. As the level of the plain is 6000 above the sea, there are 1000 feet to be accounted for. The plain contains more *Artemisia tridentata*, and *A. filifolia* in place of *Sarcobatus vermiculatus* to a very great extent, the latter being found on the lower foot-hills, above which we find but little *Phlox*, some *Lupinus*, and more *Rosaceæ* and *Compositæ*. There is here a great increase in elevation of similar species over those at Bull Run.

Again, at Belmont the *Coniferæ* end with the timber-line at 9700 feet, and where the belt of the *Salicaceæ* begins but a seam of scattering mahoganies is found, the place having been taken up by a wider belt of *Coniferæ* above and of *Salicaceæ* below. On the plains south of Belmont more saline matter is found in the soil, giving rise gradually to a more desert-like vegetation. *Artemisiæ* are less numerous, and are replaced by *Algarobia glandulosa*, the former occurring abundantly on the foot-hills, upon the upper slopes of which *Cactaceæ* now make their appearance. At Mt. Nagle and, just south of it, at Mt. Macgruder, there is little variation of elevation of the flora, so that at the latter the timber ceases to grow at 11,150 feet (covering the summit of Mt. Nagle at an altitude of 11,000 feet), the belt of *Coniferæ* running down to 8500 feet, when the belt of *Salicaceæ* occupies the space down to an elevation of 8100 feet above the sea. The belt of the *Compositæ* now rests upon one of *Yucca buccata* and *Y. angustifolia*, which, farther down on the foot-hills, is replaced by *Cactaceæ*, and on the desert by the *Artemisia triden-*

tuta and *Algarobia glandulosa* in excess. The plains and salt marshes in this vicinity are at an elevation of 7200 feet above the sea, and gradually slope towards the Colorado River, until we reach the deserts just north of that valley, where the average elevation is 1400 feet. This descent is so rapid, comparatively, that as we proceed southward, zones or belts of vegetation are passed through — underlying that upon the salt deserts at Macgruder — not encountered heretofore, and which partake of a sub-tropical nature in predominating species, that is, *Cactaceæ*, such as *Echinocactus*, *Mamillaria*, *Agava*, and *Larrea Mexicana*.

Southward and eastward of the Colorado River, in following this elevated portion of the country, we encounter the Colorado Plateau, having an elevation of from 6000 to 6700 feet. Upon this we have San Francisco Mountain and Mt. Bill Williams. Upon the former, the timber-line rises to within one thousand feet of the summit upon the eastern side (12,500 feet) and to within five hundred on the western (13,000 feet).

The belt of *Coniferæ* extends down to the base of this mountain as well as on Mt. Bill Williams,[1] and is subdivided into two divisions, the upper being composed chiefly of *Pinus brachyptera* and *P. edulis* Engelm., and the lower of *Abies Douglasii* and *Juniperus occidentalis*. Throughout the ravines and moist depressions we now find *Fraxinus velutinus* common, and scarcely any *Populus monilifera*. Around the base of both mountains we find *Quercus Gambelii* extending up the eastern slopes but *not* upon the western.

After leaving the plateau, going southward, and again descending to an elevation of 3500 feet, we meet the belts of sub-tropical species which occur above the plateau (in Southern Nevada) at a corresponding place, allowing the increase of elevation which it gains in this distance proportionately.

As we descend toward the valley of the Rio Gila, *Cactaceæ* predominate, nine species having been identified, not embracing varieties which are undoubtedly present and which could have been detected upon closer examination. Farther west, including the Mojave Desert, and northward as far as Vegas Valley, we find this thorny vegetation to a great extent ; and in various depressions and ravines occur *Eriodiction*, *Algarobia*, and *Prosopis*.

There is a gradual elevation, as we proceed southward, of all these zones or belts of vegetation, which may at times consist

[1] For information regarding San Francisco Mountain I am indebted to Mr. G. K. Gilbert (Geologist Geolog. and Geograph. Exp. for Explor. Nevada and Arizona, 1871–2, Lt. G. M. Wheeler, Corps of Engineers, commanding).

only of a single species (*Cerocarpus ledifolius*), at others of a genus (*Pinus*), but more frequently of a variety of genera or even of families. In the northern portion of Nevada a single genus of plants is often found occupying a large extent of rolling country, when, as we reach the limit of distribution, a few yards farther on will find us in another and a distinct group. At some points, again, the line of demarcation between the desert flora (*Artemisia tridentata*) and that of the foot-hills (*Sarcobatus vermiculatus*) is so sharply drawn as to be visible from any elevated point of observation, this being apparent on account of the difference of the color of foliage.

Again, we find areas over which the vegetation is as yet an indiscriminate mingling of genera and families, but over which the *Compositæ* appear to have the "balance of power."

This peculiar distribution is apparent over all that portion of Nevada and Arizona before named, but as we go southward we find each genus or family of plants or trees gradually rising in elevation, and if we do not discover all the preceding individuals, we find representatives belonging to the same genera or families replacing them at those altitudes, which in turn give rise to other forms, to other types, or a new belt, occupying that space caused by the elevation of the belt above. This succession is visible in following the elevated mountain regions of the American continent, but is modified in the vicinity of seas, as at Panama. As the vegetation is thickest and most luxuriant in the tropics, it forms a covering which decreases in quantity and growth towards either pole. The equatorial zone is the home of ferns and palms, which gradually lose predominance in advancing towards the temperate zones as they do in ascending the mountains situated in the equatorial regions. That at great altitudes the belts of vegetation and timber are again met with, which as cend from both the northern and southern parallels of latitude, is verified by Von Humboldt,[1] who says, "The great elevation attained in several tropical countries, not only by single mountains but even extensive districts, enables the inhabitants of the torrid zone to behold also those vegetable forms which, demanding a cooler temperature, would seem to belong to other zones. Elevation above the level of the sea gives this cooler temperature even in the hottest parts of the earth, and cypresses, pines, oaks, berberries, and alders nearly allied to our own cover the mount-

[1] Aspects of Nature, etc., Alex. von Humboldt. Trans. by Mrs. Sabine, Philadelphia, 1849, pages 245, 246.

ainous districts and elevated plains of Southern Mexico and the chain of the Andes at the equator."

This rule is also followed by representative species of birds, taking, for example, the ruby-throated humming-bird (*Trochilus colubris* Linn.), which is found from latitude 61° N. to Terra del Fuego, the southern remnant of the American continent, while it has been observed in the tropics at an altitude of 14,600 feet. I have observed it in Nevada, latitude 38° N., at an elevation of 9700 feet (timber-line), and it appears thus to be found nearly everywhere within that line, at which phenogamous vegetation ceases to exist.

Species found in Mexico are also found at an altitude in the tropics at which the same temperature and the same belt of vegetation occurs, which would place an outside limit of altitude at about 10,000 feet. M. Becquerel [1] says, "In the equatorial zone no change is observed in the vegetation from the level of the sea to the height of 600 metres (1969 feet), and beyond this even to an altitude of 1200 metres (3937 feet) we still recognize the flora of the tropical zone."

It is apparent, then, that in the distribution of a flora from north to south, or in equal directions (or nearly so) from the equator, there is a downward tendency as the latitude increases. This zone of vegetation being divided into successive layers, vertically at the torrid zone, which, as they rise in altitude, spread their termini over a section of country where they descend, give rise to a succession of changes from a torrid to an arctic flora. This zone forms an arch, when viewed in a barometric profile, from the northern to the southern hemisphere, having the greatest depression over the equatorial region.

That the regularity in location of these various belts is governed by climatic or meteorological laws, modified to some extent by geological causes, is apparent and undoubtedly true, but regarding the local distribution throughout any one of these belts there are slow changes, as on some of the deserts in Arizona or in the salt marshes of Nevada.

On the Gila Desert, as elsewhere, we observed the remains of an undergrowth of acacias (*Algarobia glandulosa*) which were destroyed by the encroaching *Cereus giganteus*, and here the law of *mutual repulsion* is forcibly illustrated. Dr. J. M. Bigelow [2] noticed the same fact in the valley of Bill Williams Fork, and

[1] In Smithsonian Report, 1869, page 401. (Translation.)

[2] Pacific R. R. Report, vol. iv., page 21. (No. 2 Botany.)

says "that it [Acacia] forms a shelter for the propagation of the *Cereus giganteus* of that region. Every young *Cereus* is protected and fostered by this tree until the cactus attains the size and hardihood that enables it to withstand the war of elements waged against it, when it ungraciously spurns its protector, ultimately destroying it, as we saw in numerous instances on our journey."

That geological and climatic influences and effects modify and in time alter the flora of a district is perceptible in the salt marshes. Here the lower forms of vegetation flourish in luxuriance, especially the *Chenopodiaceæ*, in which the higher types seem unable to exist on account of the strongly alkaline soil, and even in waters strongly impregnated with salt, forms exist which retain these places in spite of the force brought to bear upon them from the invading species which perish not from a "mutual repulsion and subjection," but from the alkalinity of the soil itself.

Mr. Lester F. Ward proposes "what might be called the law of *mutual repulsion*, by which every individual, to the extent of its influence, repels the approach of every other and seeks the sole possession and enjoyment of the inorganic conditions surrounding it; this mutual repulsion results at length in a statical condition which is always brought about through the action of the vital forces themselves, and which, as soon as reached, determines absolutely the exact place and degree of development of each species and each individual."

This is at present not the case in the salt marshes, but, when an accumulation of organic and silicious matter is the result, through the decomposition of the plants and the dust from surrounding sources, these lower types lose their predominance, and higher types replace them. This will ultimately be the result, as there is no aqueous precipitation, and the constant evaporation from the marshes will leave them nothing but alkaline deserts.

Upon the foot-hills in the upper portion of Nevada different species of plants occupy distinct patches, but it is apparent that there are changes going on, and that in time some will be destroyed, giving place for hardier varieties. Mr. Ward further says, "Each species is the perpetual and inexorable antagonist of every other. The 'struggle' is not alone 'for existence,' it is also for *space*. . . . . But the first principle, as in the rest of nature, is force. Each one encroaches with all the power of

vegetal growth upon its neighbors." Where an area of vegetation has not been disturbed by mechanical or agricultural causes, the species and genera growing thereon are to all appearances occupying their limit of growth and local distribution, as over various valleys and low elevations in Northern Nevada. "But let these statical conditions be once changed, ... and this equilibrium is immediately disturbed. The chained forces are set free; a general swarming begins; some individuals are destroyed, others are liberated; each pushes its advantage to the utmost, and all move forward in the direction of least resistance, till at length they again mutually neutralize each other, and again come under new conditions and modified forms, into the former state of quiescence." [1]

There has been great difficulty experienced in some of the fertile valleys of Nevada and California in attempting to prevent the rapid encroachment of native plants upon partially cultivated and irrigated patches of soil. They are stronger in vegetal power, and in a short time depauperate and stunt the introduced cereals and garden vegetables.

These vegetal "struggles for space and existence" are stronger and the results more perceptible in the tropics than elsewhere; rising in altitude with the superlying belts of vegetation, they decrease until the region beyond the timber-line is reached, in a similar manner as when we proceed towards either pole in almost a fixed proportion to the latitude. This is caused by a variety of influences, prominent amongst which are

(1.) The presence of saline matter to such an extent as to cause the destruction of any but the lower types of vegetable life, — *Chenopodiaceæ.*

(2.) In the sub-alpine belt or latitudes, where the *Coniferæ* predominate and where there is a corresponding temperature unfavorable to other types generally, and

(3.) Beyond the timber-line or at extremely high latitudes, where the superincumbent mass of snow in winter and the extremely short temperate season prevent the growth of almost anything save lichens and mosses.

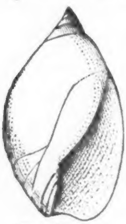
[1] Mr. L. F. Ward, Popular Science Monthly, October, 1876.

ABORIGINAL SHELL MONEY.

BY ROBERT E. C. STEARNS.

IN several articles heretofore published,[1] I have written on the use of various species of shells for the purposes of money by the aborigines of North America, and have also briefly referred to the use of the same class of material for similar purposes in Africa and India, and the antiquity of shell money in the latter country.

Since the date of my last paper additional data have been acquired, which are worthy of note as they relate to certain West American species of mollusks not before enumerated, the shells of which have been and to some extent are still used for money by some of the Indian tribes in California.



(FIG 62.) OLIVELLA BIPLICATA SBY.

The discovery of a species of Olivella (*O. biplicata* Sby.) in ancient graves on San Miguel Island (one of a cluster of islands thirty miles westerly) off the southerly coast of this State was referred to in a previous paper. I have since examined specimens of the same species, found by Mr. C. D. Voy in a burial mound near Vallejo, in Solano County, in the year 1872, now in the museum of the University of California, which also contains much rare and interesting prehistoric material collected by the same person in various parts of the State. Of this species about two hundred specimens were obtained from the Vallejo mound, as well as human remains and numerous aboriginal relics, such as stone pipes, bone whistles, and arrowheads, also another form of shell money and ornament described further on.

In all of the Olivellas from the Vallejo mound, the upper part of the spire or the apex of each shell has been ground off in the same manner as in the San Miguel Island specimens,[2] and it is presumed that they were formerly strung and worn as a necklace, an ornament for which these shells are still used by some of the interior Indians of Central California, as I have been informed by Mr. Stephen Powers, a most excellent authority. He says that this form is now used for personal adornment by the Bear River Indians, and is by them called "colcol." Referring to the shells he writes, "They are strung double, that is, two strings of them

[1] American Naturalist, March, 1869; Overland Monthly, April, 1873; Proceedings of the California Academy of Sciences, July, 1873.

[2] Collected by Mr. W. G. W. Harford.

are tied together between each two shells, so that the shells are mouth to mouth. But even this double string is lightly esteemed, being worth only one dollar a yard. It is little used for money, being rarely seen at all, and is worn chiefly by the women in dances as a cheap jewelry."

The specimens kindly sent to me by Mr. Powers are of the white variety, which are much less abundant than those of the usual bluish tinge; neither are these nor any of the grave specimens above a medium size, for this species frequently attains a length of an inch and a quarter, as may be seen in Figure 62. The Vallejo mound specimens average only half an inch, which fact suggests that the smaller size may have been more highly valued.

(Fig. 63.) COLCOL.

It will be observed that the Olivellas, or colcol, have been found in ancient graves on San Miguel Island associated with human remains and prehistoric implements, also by Mr. Voy in Solano County, and Mr. Yates in a recent article reports their occurrence in the mounds of Contra Costa and Alameda counties.

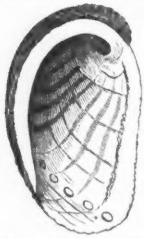
By reference to a map of California it will be seen that these last localities are widely separated from the first named, and it implies not only the general use of this species of shell by the maritime tribes, but also a line of intercourse and a system of traffic between the coast tribes and those of the interior, as suggested in a previous paper, and through which the colcol finally came to be used by the Indians of the central part of the State.

In my first paper,[1] alluding to the use of *Saxidomus gracilis*, a common bivalve on the coast of Sonoma County, I expressed surprise that the equally common and far more beautiful shells of *Haliotis rufescens* had not attracted the attention of the aborigines, and been utilized by them for money and personal decoration. It will be seen, however, that the beauty of these has not escaped the eye of the savage, but that they have been used both for money and for personal decoration, and been fashioned into a variety of shapes for the latter purpose, the prototypes of the "abalone jewelry" so popular with the "pale-faces" of to-day.

From the Vallejo mound Mr. Voy obtained various pieces of Haliotis, or abalone, as the Californians call it, which is the *aulon* or *aulone* of the Spanish, and the *uhllo* of the Indians. In reference to the Indian name Mr. Powers writes: "Your conjecture

[1] American Naturalist, March, 1869.

that the word *uhllo* is corrupted from the Spanish *aulon* is probable, although the Indians accent the first syllable, giving it a sound difficult for us to imitate, somewhere between *uh* and the German *ö*."



(Fig. 64.) HALIOTIS OR ABALONE.

The accompanying illustrations represent the specimens taken from the Vallejo mound in the year 1872, with which, as before stated, were found human remains and numerous aboriginal relics. They form a part of the Voy collection presented to the University of California by Mr. D. O. Mills, of San Francisco.

These ornaments and this money, if we may consider the circular pieces as the latter, are all made from the same species of Haliotis (*H. rufescens* Swainson), the common red-backed abalone of the coast, which has a range of nearly the entire shore line of the State; and a large species which sometimes attains a length of eleven inches.

In Figure 2 of Plate II. we have an approximately circular disk; Figure 1 in the same plate may have been nearly the shape of 2, and have become partially disintegrated and scaled or flaked off, since it was buried, through oxidation and decay. The dark patches on these figures represent the red exterior of the shell from which they were made, and which still remains on the specimens. Figure 3 is well worked out, a nearly perfect circle with the edges neatly serrated or toothed, as if done with a sharp piece of obsidian, while Figure 4, though without apparent design, has been rubbed or rounded so as to make the edges smooth, as have also the pieces figured in 1 and 2, and the holes have been carefully perforated. Figure 4 shows the mark where a hole was started and not completed, probably from its being too near the edge.

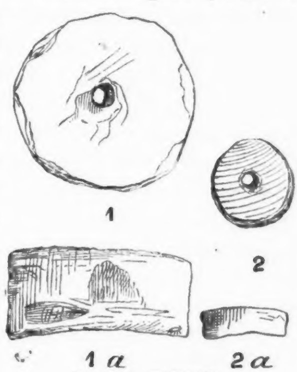
Over a dozen of these disk-shaped pieces, including those figured, were found by Mr. Voy, and Mr. Yates also records approximately similar forms of smaller size, though he does not state the species of Haliotis from which his specimens were made. Mr. Henry Edwards, the entomologist, has also obtained this abalone money from the kitchen-middens of Marin County, near Saucelito.

Mr. Powers, referring to the use of Haliotis, says, "The uhllo pieces are of a uniform size on the same string; they do not mix them. The dollar pieces (Plate II., Figure 5) are generally about one and one quarter inches long and an inch wide; the smaller about as long but narrower; . . . a couple of fragments

I picked up in an old Indian camp (Plate II., Figures 6 and 7) are worth twenty-five cents each. The Indians are very ingenious and economical in working up the aulones: wherever there is a broad, flat space they take out a dollar piece; where the curve is sharper, smaller ones. They especially value the outer edge [1] of the whorl or lip, where the color is brilliant, and these they are obliged to cut into twenty-five cent pieces. You will see that the uhllo is cut into pieces of different sizes, and even pieces of the same size vary in value according to their brilliancy. . . . All the money that I have seen was strung on grocery twine, but they often use sinew of various kinds, also the outer bark of a weed called milkweed [2] about here." [3]

The uhllo necklace has three or four strings of very small glass beads above the shells, forming a band about one quarter of an inch wide, which encircles the neck. . . . A common deep conical basket, of about a bushel and a half capacity, such as the squaws use for carrying their household effects, is worth one and one half or two strings of uhllo, that is, fifteen or twenty dollars.

Another form of money is made from the heavy shells of a bivalve, a ponderous clam (*Pachydesma crassatelloides*) peculiar to the southern coast of California. This is cut into circular pieces of the diameter as shown in the annexed figure (65), the thickness of the pieces varying with the thickness of the shells from which they are made. The larger pieces (Figure 65, 1 and 1 *a*), of the value of twenty-five cents, are cut from the thicker parts of the valves, and the smaller (Figure 65, 2, 2 *a*), of the value of four cents each, from the thinner portions. This money, of which the smaller pieces closely resemble the disk-shaped beads of the natives of the Paumotu Islands in the South Pacific,[4] except in being of twice the diameter and thick-



(Fig. 65.) HAWOCK.

[1] Columella. [2] Asclepias. [3] Placer County, Cal.

[4] The Paumotus are in about longitude 130° W. and latitude 23° S. The pieces made by these islanders are of about one half the diameter and one half the thickness of Figure 5; they are made of *Oliva carneola*, and it must require great labor, as these transverse sections are formed by grinding off the small upper whorls of the apex, and also nearly the entire body whorl, until a disk is obtained of an average thickness of only one twelfth of an inch; these are strung alternately with thinner disks of the same diameter, made of the inner hard shell of the cocoanut, forming a neat necklace, with a pleasing contrast of black and white.

ness, is strung upon strings the same as beads in a necklace, for which purpose it is also used. Figure 5 is the same in form and of about the size of the pieces made from *Saxidomus gracilis* (*S. aratus*), according to Yates, and in use "among the Indians of Lake County. Eighty of these disks are valued at one dollar."

This money, which is called *hawock*, according to Mr. Powers, is universal throughout Middle and Southern California, though different tribes call it by different names and attach different values to it.

"Sometimes disks of hawock are made two inches in diameter and half an inch thick, which are rated at one dollar a piece, but such large pieces are seldom seen."

"The Bear River Indians (Neeshenams) are the only ones I have seen who count it by the single piece, the others rate it by the foot or yard. . . . It is sometimes strung upon a string many yards long, in hundreds of pieces, and doubled into lengths of about a yard. The Wi-Lackees make the buttons thin, then every tenth one thicker, so that it looks like a Catholic rosary, and their name for it is *tocalli*."

In a photograph of a young woman of the Bear River Indians, named Válputteh, received from Mr. Powers, her person is adorned with a necklace of hawock which, it is stated, is ten yards long, requiring to be wound several times about her neck, and consisting of about 1160 pieces, valued at $232. Another of the same tribe, Pedah or Captain Tom, has an inventory of money and ornaments made of the uhllo (Haliotis), hawock (Pachydesma), and colcol (Olivella), of the total value of $479. The uhllo, however, seems to be the most highly prized, and in various ways is wrought into gorgets, girdles, and head-dresses, as the hawock and colcol is principally used for necklaces. Gorgets of Haliotis are especially valued, as they require a large and fine shell for this purpose.

Upon reviewing the present and my previous papers, it will be observed that the species of shells named in the following table have been or are now used as money by barbarous tribes on this continent and in other parts of the world.

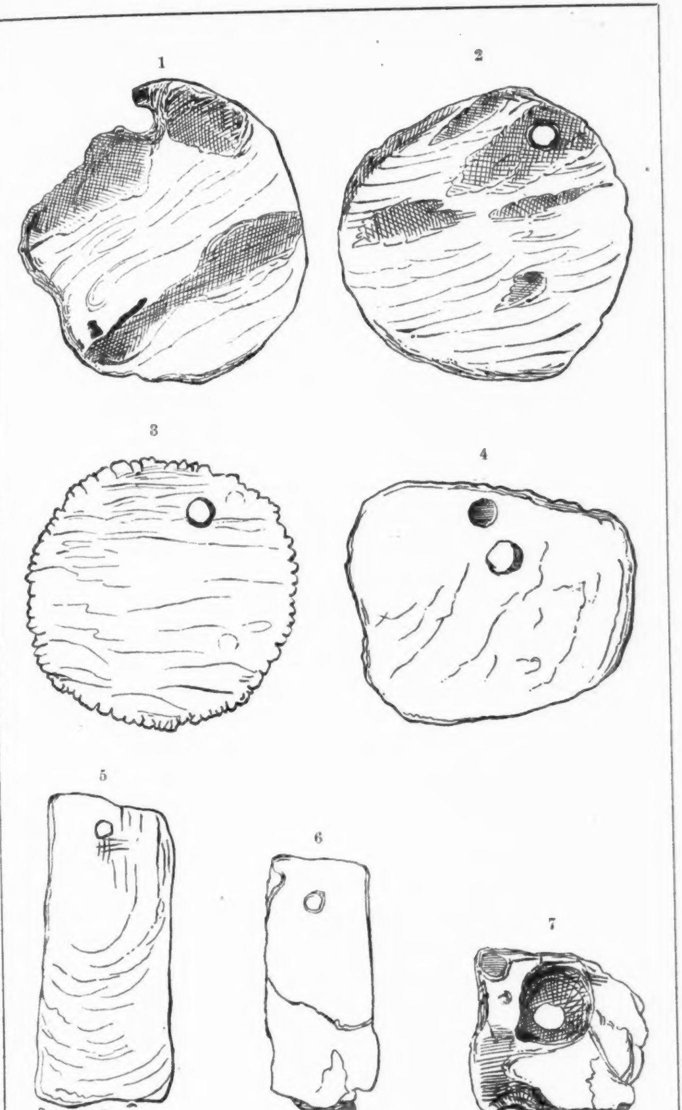


PLATE II. ABORIGINAL SHELL MONEY.

NORTH AMERICA. — West Coast.

Scientific Name.	Popular Name.	Aboriginal Name of Shell.	Aboriginal Name of Money.
Dentalium Indianorum Cpr. = D pretiosum Sby	Tusk or Tooth Shells	Alli-co-chick or Alli-co-cheek of California Indians	Hi-qua or Hy-a-qua of Alaskan tribes.
Dentalium entalis L.*	Tusk or Tooth Shells		
Olivella biplicata Sby	Periwinkle	Used by California Indians	Col-col.
Haliotis rufescens Swainson	Abalone, Aulon, or Aulone	Used by California Indians	Uhl-lo.
Fissurella (Lucapina) crenulata Sby	Keyhole limpet	Used by California Indians	Unknown.
Saxidomus aratus Gld. = S. gracilis Gld	Clam	Used by California Indians	Unknown.
Pachydesma crassatelloides Conr	Clam	Used by California Indians	Hawock and Tocalli.

NORTH AMERICA. — East Coast.

Scientific Name.	Popular Name.	Aboriginal Name of Shell.	Aboriginal Name of Money.
Venus mercenaria L. = Mercenaria violacea Schum	Hard Shell Clam or Quahaug	Poquahauges or Poquahock	Black Wampum or Wampampeege.
Pyrula (Busycon) carica L	Whelk	Metanhock	White Wampum or Suckanhock.
Pyrula (Busycon) canaliculatum L	Whelk	Metanhock	White Wampum or Suckanhock.
Buccinum undatum L	Whelk	Metanhock	White Wampum or Suckanbock.

INDO-PACIFIC AND AFRICAN REGIONS.

Scientific Name.	Popular Name.	Aboriginal Name of Shell.	Aboriginal Name of Money.
Cypræa moneta L.†	Guinea money and Prop Shell	Unknown	Unknown.
Cypræa annulus, L.‡	Ringed cowry	Unknown	Unknown.
Littorina obesa Sby	Unknown	Unknown	Unknown.
Nerita polita L. (banded var.)	Unknown	Unknown	Unknown.
Unknown species	Used in Soudan	Oudâas or Woodahs	Unknown.

* Imported from Europe for the Indian traffic, by the fur-traders of the North.

† Imported by the Europeans from the Maldive Islands, for the African trade. Also in use in India in the sixth and seventh centuries, and since.

‡ Found by Layard, in the ruins of Nimroud.

GAMING AMONG THE UTAH INDIANS.

BY EDWIN A. BARBER.

IN their indolent hours, gaming and horse-racing are extensively resorted to by the nomadic tribes of America. Having much unoccupied time on their hands, they turn to these exciting amusements as a relief from the consuming *ennui* of idleness.

During the summer of 1874, I had some opportunities for studying the habits of the Yampa branch of the Utah nation, located in the northwestern corner of Colorado. In strolling through their encampment, one was always attracted to several of the more prominent *wick-e-ups*, or canvas lodges, by the sound of subdued music, and on entering either of the tents, the visitor was rewarded for his trouble by the sight of several warriors engaged in gambling. So great, indeed, is their earnestness when engaged in this pastime that they do not observe the arrival of strangers, and as they progress they become so deeply absorbed in the exciting reverses of the game that they can only be awakened to a consciousness of surrounding objects by the greatest exertion. They may commence by putting up small articles of apparel or ornament, such as moccasins, necklaces, or strings of beads. Should these be lost, blankets, powder, lead, caps, flour, the highly prized wampum, and other miscellaneous articles will be staked, and the unfortunate loser not infrequently comes out of the play-room without an object in the world that he can call his own or his wife's. All is lost, including his horses, his house, and even the very rags he has on his back.

The manner of procedure is as follows: A row of players, consisting of five or six or a dozen men, is arranged on either side of the tent, facing each other. Before each man is placed a bundle of small twigs or sticks, each six to eight inches in length and pointed at one end. Every *tête-à-tête* couple is provided with two cylindrical bone dice, carefully fashioned and highly polished, which measure about two inches in length and half an inch in diameter, one being white and the other black, or sometimes ornamented with a black band. At the rear end of the apartment, opposite the entrance, several musicians beat time on rude parchment-covered drums. The whole assembly, sitting "Turk fashion" on the ground, then commence operations. The pledges are heaped up near the players, and each couple soon becomes oblivious of all the rest. One of the gamblers incloses

a die in each hand, and, placing one above the other, allows the upper bone to pass into the lower hand with the other die. This process is reversed again and again, while all the time the hands are shaken up and down in order to mystify the partner in the passing of the dice. The other man, during the performance, hugs himself tightly by crossing his arms and placing either hand under the opposite arm, and, with a dancing motion of the body, swaying to and fro, watches the shuffling of the dice with the closest attention. When this has gone on for a few minutes, the latter suddenly points with one arm at the opposite arm of his partner, and strikes himself under that arm with the other hand. Whichever hand of his rival he chooses is to be opened, and if the dice are in it, the guesser takes them and proceeds in the same manner. If, however, he misses, and the dice are not there, he forfeits one counter, and this is taken from his bundle and stuck into the ground in front of the other. Thus the game continues until one or the other has gained every stick, when he is proclaimed the winner and carries off the stakes. During the entire game, the players, as well as the musicians, keep time to the accompaniment in their movements, and chant the while a weird, monotonous tune (?) which runs in this wise:

No words are sung, but the syllable *ah* is pronounced in a whining, nasal tone for every note. The entire party keep excellent time, and are always together, rising and falling in the scale with wonderful precision, since the tune itself is so devoid of melody that it is often difficult for a white man to acquire it. This monotonous chant is kept up for hours and even days, and the competitors seem never to grow weary. The war and dance

songs of the Utes are different from this, yet they are somewhat similar.

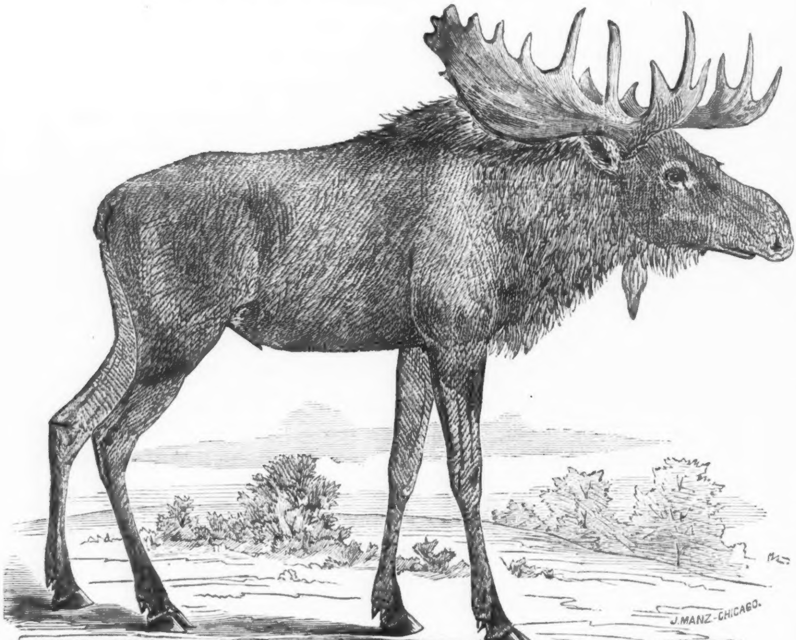
Gaming is not confined to the male sex of the tribe, but is indulged in to some extent by the squaws. During the palmy November days of Indian summer, when the whole tribe throw off care and give themselves up in a measure to enjoyment, the old crones will often gather for a game of chance, on a more limited scale. All their trinkets and gewgaws are brought out and their ornaments stripped from their persons, and the game of chance proceeds. I have frequently seen these toothless old hags quarreling over some paltry toy, with a pack of filthy playing-cards in their hands. But assuredly they do not play any standard game with them; they have methods of their own, of which I could make nothing. These cards are obtained from traders and explorers, but when they cannot be had, the squaws will simulate the American cards in their own rude manufactures: the spots are represented by fanciful devices, and the face-cards by grotesque paintings. The men usually disdain these feminine methods of gaming, and practice the more exciting mode as I have described it above.

In this connection it might be well to say a few words relating to the negligence of ethnologists in omitting to collect the songs and chants of the American tribes, when it has been in their power. This branch of the science seems to have been entirely overlooked (excepting in a few instances), though it is almost as important as many others which are studied so assiduously. That the tunes or dirges of unallied families differ to a great extent there can be no doubt, and frequently these are of as much importance in seeking to determine affinity or relationship as the study of philology. It is desirable, therefore, that every chance be seized for jotting down these native chants, as in a very few years more such opportunities will have passed away forever.

N. B. Since this paper was placed in the hands of the editor, a Bulletin has been issued by Hayden's United States Geological Survey, containing an interesting article on the Twana Indians of Washington Territory, by the Rev. M. Eells, in which their modes of gambling are mentioned. The second game played by this tribe bears a singularly striking resemblance to the above-described method, differing principally in the musical accompaniment. It is probable that the *two-bone game* was, and is still, common among many of the western tribes.

RECENT LITERATURE.

CATON'S DEER OF AMERICA.[1] — We notice this important work from advance sheets kindly furnished by the publishers. The author is well known to have devoted much time and care to the study of the *Cervidæ*, and has already published many articles on the subject which have shown him to be a close and accurate observer, and have made him the highest authority in this country respecting all that relates to the natural history proper of these valuable and interesting quadrupeds.



Male Moose.

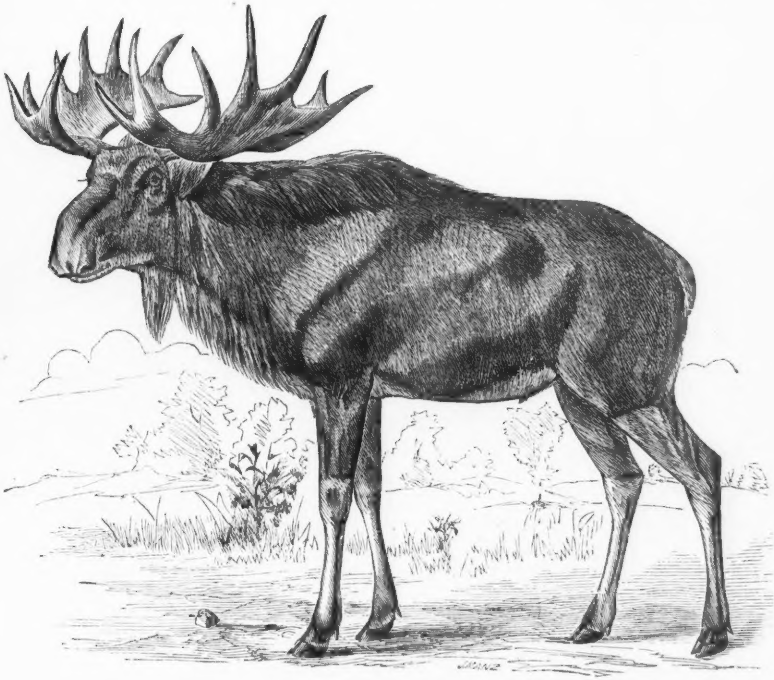
(FIG. 66.)

In the present work we have the final outcome and thorough digest of his long studies, in the form of an exhaustive monograph which will at once become the standard authority. He is to be congratulated upon this consummation, which will redound so largely to his reputation as an

[1] *The Antelope and Deer of America* A Comprehensive Scientific Treatise upon the Natural History, including the Characteristics, Habits, Affinities, and Capacity for Domestication, of the Antilocapra and Cervidæ of North America. By JOHN DEAN CATON, LL. D. New York: Published by Hurd and Houghton; Boston: H. O. Houghton and Company; Cambridge: The Riverside Press.

observer of nature, and we congratulate ourselves upon the acquisition of so careful, so thorough, and so reliable a treatise.

We do not take the present occasion for any elaborate review of the work, in which to track after statements with the view of verifying or criticising particulars; we wish rather simply to point out the general character of the work, and bring its high average of merit and reliability prominently into view. The work is open to serious criticism in the matter of the classification which the author has seen fit to adopt,

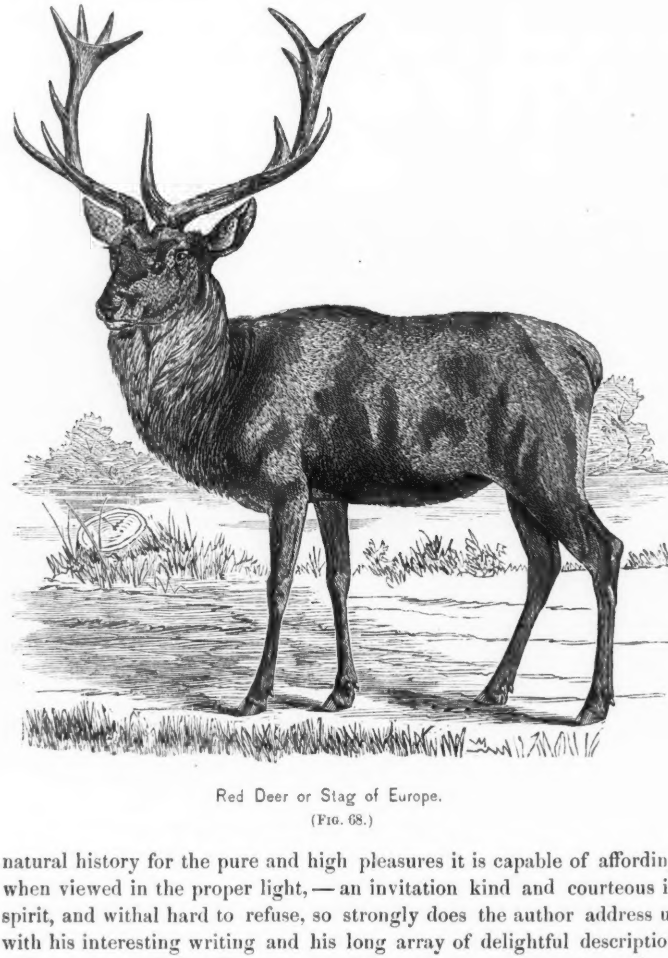


Scandinavian Elk.
(FIG. 67.)

and we doubt that his views on this portion of the subject are sound, from a purely scientific stand-point, or that they will receive the countenance of professed therologists. But we do not think that this criticism will in the least disturb the author, who seems to have aimed at some convenient arrangement of the ruminants, by which the relations of the species he treats may be readily recognized, rather than any formal presentation of the technics of the case. And we would immediately add that his elaborate, minute, and faithful descriptions of the species put us in possession of exactly the facts that we should most wish for

were we to undertake such a classification as the author does not give. Here are the materials, in short, upon which to work at the taxonomy of the subject.

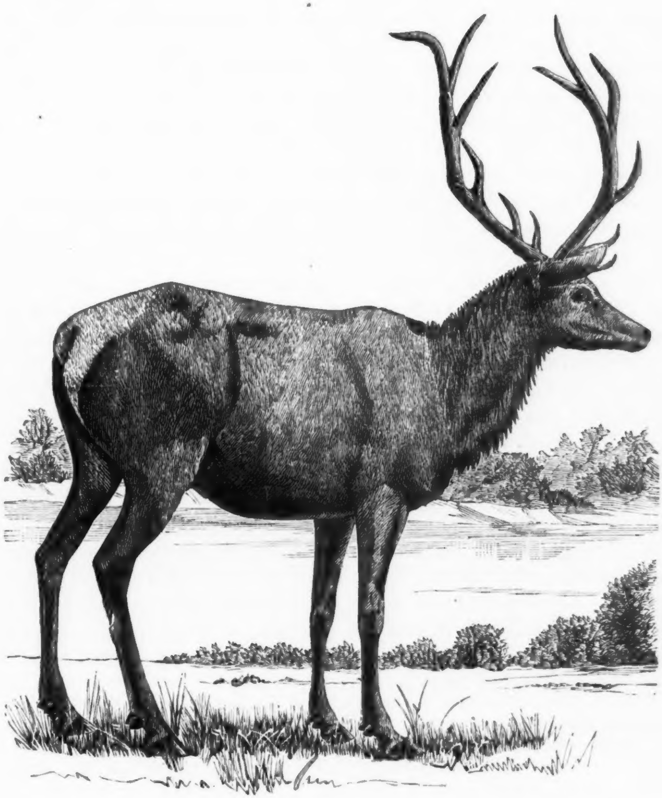
In preparing this work, the author seems to have kept steadily in view the special object of promoting a taste for natural history among those who are fond of field-sports. It is an invitation to all such to study



Red Deer or Stag of Europe.
(Fig. 68.)

natural history for the pure and high pleasures it is capable of affording when viewed in the proper light, — an invitation kind and courteous in spirit, and withal hard to refuse, so strongly does the author address us with his interesting writing and his long array of delightful description and narrative. Judge Caton is one of those pleasant, persuasive writers who will take no denial; he carries us along whether we will or not, and ends by making us wonder why everybody does not turn to keep-

ing deer and studying their structure and habits! But, quite seriously, we would urge the double delight that all sportsmen and hunters may experience, if, instead of ending their interest in game with killing it, they would capture animals and birds, and study them. This would, moreover, be excellent service rendered to science; should it ever become general, new and interesting facts would accumulate with astonish-



Male Elk or Wapiti of America.
(FIG. 69.)

ing rapidity, and the most desirable results would immediately follow. In fact it is not too much to say that in the present state of zoölogical science in this country the technical scientists, full of their skulls and teeth and dry hides and their taxonomic refinements, are turning eager eyes toward the sportsmen and practical field naturalists, in the hope of learning what they now most need to know. Judge Caton in himself

illustrates the honorable capacity of the amateur naturalist (we use the term in its best sense, implying high credit, without a shade of the reverse) to supplement museum-acquired learning with other information of equal scientific importance, of greater practical utility, and much more general interest. This is exactly what the present work very conspicuously accomplishes. It will, we make no doubt, meet with a hearty welcome, and have a wide-spread influence for good. For ourselves, engaged as we are upon a general history of North American Mammals, we would thank the author personally for a contribution so timely and so exactly to our hand; we are selfishly pleased to find so generous a slice of the work already cut and dried for our own use.

As already intimated, we do not here propose any elaborate review of the work in detail, and we close with allusion to a few leading points: the prongbuck is very fully treated in the first sixty-five pages; then follow the eight "distinct and well-defined" North American species of *Cervidæ*, namely, the moose, the wapiti or American elk, the two species of reindeer, woodland and barren-ground, the common or Virginian deer, the mule deer (commonly called black-tail in the West), the Columbian or true black-tailed deer of the Pacific slopes, and a curious little species, lately described by the Judge as new, under the name of *Cervus Acapulcensis*. We are not acquainted with the latter; the recognition of the other seven agrees with our previous impressions on the subject, and with the now generally accepted views of the best authorities. These species occupy pp. 66–322. The work very properly continues with a comparison of the several European species. Persons are frequently puzzled by the reverse use of the terms "moose" and "elk." The author makes it perfectly clear that the American *moose* is the analogue of the palmate-horned animal called "elk" in Europe; and that the American *elk* is the analogue of the stag or red deer of Europe. From among the many characteristic wood-cuts which illustrate the volume, we have selected as most useful to reproduce for our readers the four pictures which show up this point. — E. COUES.

RECENT BOOKS AND PAMPHLETS. Notes on the Osteology and Myology of the Domestic Fowl (*Gallus domesticus*), for the use of Colleges and Schools of Comparative Anatomy and for the Independent Zoölogical Student. By Victor C. Vaughan, Ph. D. Sheehan & Co. Ann Arbor, Mich. 1876. 12mo, pp. 116, with cuts. $1.50.

How to Camp Out. By John M. Gould. New York: Scribner, Armstrong, & Co. 1877. 12mo, pp. 134.

Brehm's Thierleben. Band 9, Heft 1–7. Leipzig. 1877. For sale by Westermann & Co., 524 Broadway, New York. 40 cents a Heft.

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U. S. Entomological Commission. Circular 1, 2. Bulletin 1. Destruction of the Young or Unfledged Locusts. Washington, D. C. Department of the Interior. U. S. Geological and Geographical Survey of the Territories. F. V. Hayden in charge. 8vo, pp. 12.

The Insects of the Tertiary Beds at Quesnel, British Columbia. By S. H. Scudder. From the Report of Progress 1875–6. Geological Survey of Canada. 8vo.

Variations in the Colors of Animals. By S. W. Garman. (Reprinted from vol. xxv. of the Proceedings of the American Association for the Advancement of Science.) Salem. 1877. 8vo, pp. 17.

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Studien an Turbellarien. Beitrage zur Kenntniss der Plathelminthen. Von Charles Sedgwick Minot aus Boston. (Arbeiten aus dem Zoologisch-Zootomischen Institut in Würzburg.) Hamburg. 1877. 8vo, pp. 83, 5 plates.

Die Verwandtschaftsbeziehungen der gegliederten Thiere. III. Strobilation und Segmentation. Ein Versuch zur Feststellung specieller Homologien zwischen Vertebraten, Anneliden und Arthropoden. Von C. Semper. (Arbeiten aus dem Zoologisch-Zootomischen Institut in Würzburg. Bd. iii. Heft 2, 3.) 8vo, pp. 289, 11 plates.

Discours prononcé par J. J. A. Worsae, Vice-Président devant la Société Royale des Antiquaires du Nord, à l'occasion du 50me Anniversaire de la Fondation, dans la Séance du 28 Janvier, 1875. 8vo, pp. 39 (with portrait of Rafn).

Descrizioni di alcune Specie di Opilioni dell' Arcipelago Malese appartenenti al Museo Civico di Genova, pel Dott. T. Thorell. 8vo, pp. 28. 1876.

Due Bagni exotici descritti dal Dott. T. Thorell. Genova. 1877. 8vo, pp. 10. (Estratto dagli Annali del Museo Civico di H. Nat. di Genova.)

Ueber Helicopsyche als eine der Schweiz, Insectenfauna angehorende Phryganide erkannt. Von C. von Siebold. 8vo, pp. 7.

Beitrage zur Schmetterlings-Fauna von Surinam. Von H. B. Möschler. 8vo, pp. 60, two plates.

Estheria Californica Pack. Inaugural-Dissertation zur Erlangung der Phil. Doct. Von H. Lenz. 8vo, pp. 16.

Die Stammväter unserer Hunde-Rassen. Von L. H. Jeitteles. Wien. 1877, 12mo, pp. 68.

Indices d'au nouveau Genre de Mammifères édentes, Fossile dans les Dépôts eocenes dits de Saint Ouen. Par Paul Gervais. 4to, pp. 5.

Observations relatives à un Squale Pèlerin récemment pêché à Concarneau. Par MM. Paul Gervais et Henri Gervais. 4to, pp. 5. (Extrait des Comptes rendus des Sciences de l'Académie des Sciences. 1876.)

Round the World in 320 days. Six Months of Inland Excursions. Programme of the First Voyage. Organized by La Société des Voyages d'Etudes autour du Monde. London: Trübner & Co. 1877. With plan and chart. 12mo, pp. 54.

GENERAL NOTES.

BOTANY.[1]

Vegetable Digestion.[2] The following note is an abstract of Professor Morren's communication:—

There is no doubt that certain plants have the power to allure, retain, kill, dissolve, and absorb insects and even larger animals. There is nothing astonishing in this, for to my mind the facts observed among the carnivorous plants are in perfect harmony with the general theory of the nutrition of plants.

Digestion is not the exclusive characteristic of carnivorous plants, but is common to all living beings, animal as well as vegetable. In animals, digestion in its essence is considered by chemists to be an indirect fermentation, consisting of an hydration, followed by a splitting up into new and more simple forms of the digestible materials. These marvelous and necessary transformations are accomplished by the action of mysterious and powerful substances called ferments. The ferments are derived, according to all appearances, from the albuminous matters, and seem to be a part of the protoplasm itself. They are more or less distributed throughout all the animal organism, but particularly abundant in the juices which are secreted especially in view of digestion, such as the saliva, gastric, pancreatic, and intestinal juices. They may be extracted in a separate form and their activity still be preserved.

The food, as it is taken in by the animal, is not usually in a state fitted to pass into the system, and these ferments act upon it and produce the necessary changes, the albuminoids pass into "peptones," starch into sugar, fats into an emulsion, each class of foods being transformed by its own appropriate ferment.

Plants also take in their food in a crude state, and digestion is as essential with them as with animals. The ferments form an integral part of the vegetable organism, and are even more numerous in the vegetable than the animal kingdom.

Diastase or *glycosic ferment.* This is the digestive ferment of amylaceous substances. By its influence starch is hydrated and divided into the readily soluble products, dextrine and glucose —

$$2(C_6H_{10}O_5) + H_2O = C_6H_{10}O_5 + C_6H_{12}O_6$$
$$\text{Starch} + \text{water} = \text{dextrine} + \text{glucose.}$$

In animals these changes are brought about by the saliva and pancreatic juice. A fine illustration of this action among vegetables is seen in the germination of masses of barley, or malting as it is commonly termed.

[1] Conducted by Prof. G. L. Goodale.

[2] *La Digestion Vegetale*, note sur le rôle des ferments dans la nutrition des plantes, communiquée a l'Académie Royal de Belgique dans sa séance du 21 Octobre, 1876. Par M. Edouard Morren, Professor a l'Université de Liége.

This action of diastase probably takes place when any reservoir of starch is used by a plant for purposes of growth. "We are not to occupy ourselves here with the nature and origin of diastase, still less with its action. . . . . Suffice it to state for the present that chemists establish no distinction between the animal and vegetable diastase, of which the power is the same and the rôle identical."

"*Ferment inversif.*" Saccharose, like starch, is a ternary compound accumulating in certain tissues in view for its need in nutrition, as in the stem of the sugar-cane, or root of the sugar beet. Though soluble it is not assimilated as such by animals, but is split up by this transposing ferment into glucose and levulose or transposed sugar.

$$C_{12}H_{22}O_{11} + H_2O = C_6H_{12}O_6 + C_6H_{12}O_6$$
$$\text{Saccharose} + \text{water} = \text{glucose} + \text{levulose.}$$

These changes are seen on a grand scale in the beet root during the flowering of that plant.

Emulsive and *saponaceous ferment.* The fat bodies are digested in the intestines of animals by means of pancreatic juice by first making them into a fine mechanical mixture followed by a somewhat complicated chemical change called saponification, or hydration and division into glycerine and fatty acids. For example: —

$$C_3H_5(C_{18}H_{33}O.O)^3 + 3H_2O = C_3H_8O_3 + 3(C_{18}H_{33}O.HO)$$
$$\text{Trioleine} + \text{water} = \text{glycerine} + \text{oleic acid.}$$

This same ferment exists in vegetables. Oleaginous seeds when ground up in water form an emulsion, and if allowed to stand for a time glycerine and fatty acid are produced. There is no doubt that the oils and fats in vegetables constitute a nutritive provision, as the grains of Crucifers, Linum, and bulbs of the Onion will show.

Albuminous ferment; pepsine. We come now to the digestion of nitrogenous substances under the influence of the pepsine of the gastric juice. Mr. Darwin, as his work on Insectivorous Plants will show, believes there is no doubt but that plants have this same power, and quotes M. Frankland's experiments, in which he found pepsine in the glands of the Drosera. More recently MM. Max Rees and H. Will (Bot. Zeit. 29 Oct., 1875), have extracted this ferment by the usual process, and with it they have caused artificial digestion of fibrine. It is in the grains that there is most frequently found a considerable quantity of albuminoids stored up as gluten, legumin, and aleurone to serve the requirements of the germinating plantlet. These substances are usually in an insoluble state, but are dissolved as required. The ferment doing this valuable work of solution is not thoroughly understood. MM. Gorup-Besanez and H. Will (Bericht der Deutsch. Chem. Gesells., Berlin, 1874, p. 1478) state that the seeds of *Vicia sativa* contain with starch a notable proportion of legumin, and when these seeds germinate the legumin disappears, and *leucine* and *asparagine* are produced; and they presume these bodies result from a division produced by a

ferment residing in the seed. The grains of Vicia were treated first for forty-eight hours with alcohol and afterwards with glycerine. Drops of such solutions were placed on starch of which notable quantities were changed into sugar, while similar liquids in which seeds had not been digested produced no change. It is safe to conclude that the existence of a pepsine ferment is established in the vegetable kingdom. Thus we have established among plants the digestion of starch, sugar, oils, and albuminoids, precisely the four normal kinds of digestion in man and animals. But we find still other and often very complicated vegetable ferments, such as the *myrosine* causing the mustard fermentation, and *pectose* of the pectic fermentation.

The similarity of composition of milk and endosperm, or in other words the food of the young animal, and young plant, has long been noticed. As an illustration we give the following: —

WHEAT FLOUR (DRY).			COW'S MILK (DRY).		
Starch	780	800	Sugar of milk	347	605
Fatty matters	20		Butter	258	
Gluten	170	190	Caseine	242	339
Albumen	20		Albumen	95	
Salt		10	Salt		56
		1000			1000

Both contain two ternary and two nitrogenous ingredients. During germination the endosperm undergoes nearly the same changes as the milk in the digestive system of the animal. The digestive power of vegetation appears very evident if we consider those plants destitute of chlorophyll. Thus the Bactaria and similar plants are representatives of fermentation. But the majority of plants have chlorophyll, and their activity differs from those without it, by their absorbing carbonic dioxide and elaborating their own food.

To consider only the phenomena which interests us at this moment, one recognizes three very distinct and consecutive functions, namely, *elaboration*, *digestion*, and *assimilation*.

Elaboration has for its part the production of carbohydrates out of carbon dioxide and water. It is characteristic of chlorophyll, and takes place in sunlight, the type of its products being starch ($C_6H_{10}O_5$).

Digestion takes place in protoplasm in the presence of oxygen with a production of carbonic dioxide. It consists in a hydration not accompanied by a molecular change, by which the elaborated matter is dissolved and diffused, starch passing into glucose ($C_6H_{12}O_6$).

Assimilation is the fixing of these digested materials into the texture of the plant, the glucose passes into permanent cellulose ($C_6H_{10}O_5$).

All these processes may be confined to a single cell, as in many unicellular plants, while in the higher forms the labor is much divided.

Protoplasm includes the sum total of vegetable activity. The cells remain active during a definite time, that is to say, while their protoplasm continues to live in the shelter of the protecting membrane which it it-

self has made; finally it abandons the cell to pass to others towards the new centres of activity, but the tissues, organs, members, the organisms thus constructed remain to attest that life has passed that way, that they are the works of the activity of an organism, like the shell abandoned by the mollusk.

Much wrong has been done in contrasting the nutrition of animals with vegetables. They are the same and ought to be studied in a parallel manner. The only difference, to the advantage of vegetables, consists in this, that plants when they have utilized and applied the supplies which they possessed, have the power of taking up inorganic materials and elaborating them into new organic food, but after such elaboration, nutrition accompanied by respiration, circulation, transformation, and assimilation take place as in animals. In effect the plant, wheat, for example, accumulates a supply of nourishment in the grain near the embryo. If this accumulation feeds an animal or nourishes the plant itself, it behaves in the same manner. In the one case it is reduced to a pulp, submitted to the influence of the pancreatic, gastric, and other juices, and is finally absorbed. If the grain is placed under conditions for germination like reduction and transformations are undergone, and the plant is nourished instead of an animal.

The truth of these assertions has been demonstrated by the interesting experiments of M. Ph. Van Tieghem, upon the germination of the *Belle de Nuit* (Recherches Phys. sur la Germination. Ann. des Sc. Nat. 1873.) This able observer has nourished the embryos extracted from the grains and separated from their endosperm by means of paste of the starch of either potato or buckwheat. The grains of starch in contact with the embryo were dissolved, which proves that the necessary ferment resides in the embryo.

Many peculiar organic compounds are common to both forms of life. Formic acid, for example, found among ants, corresponds to that found in many nettles; butyric acid in perspiration to the pulp of tamarinds; palmetic acid in animal fats to the fruit of palm; oxalic acid is quite common to both; and there are numerous other like examples.

Protoplasm of both forms of life are alike, or at least, give the same reactions and have the same movements. The only thing living in a plant is its protoplasm, as it makes the cells and constructs the organism. The same may be said of the animal structure. Thus we are able to infer identity of effect from identity of cause. The unity of structure is the corollary of the unity of nutrition.

To return to carnivorous plants, we are able to recognize that abstraction made on account of their singular structure, enters as a particular case in the general theory. The most interesting thing which they present is the presence of pepsine ferment at their surface in a secreted liquid.

It is well to notice that the facts ascertained among the Droseraceæ, so strange that they have been styled idle stories, have had this happy

result, that they have opened a new horizon upon a simple and general theory.

Professor Morren closes his paper by stating his hope and desire to go still further in this difficult and interesting line of research. — BYRON D. HALSTED, Bussey Institution, March 14, 1877.

ON THE POROSITY OF WOOD. — Professor Sachs has published a preliminary communication in regard to the porosity of wood, which contains notes of many interesting experiments. Two of these will be now briefly noticed. 1. The best grade of artist's vermilion was treated with a large quantity of distilled water and repeatedly filtered through filter-paper. The pigment was now left in so fine a state that it exhibited the well-known Brownian movement. Fresh cylinders of wood three to four cm. long, cut from a living stem of a conifer, were fastened to the lower end of a glass tube which at the upper part communicated with a broad vessel; tube and vessel were filled with the pigment emulsion so that the wood was under a constant hydrostatic pressure of 160 cm. Even at the end of three days the water which filtered through was perfectly clear and contained no trace of the vermilion. The upper transverse sections of the cylinders showed that all the layers of the spring-wood were bright red, the autumn layers were not red at all, or at most only in radial stripes, the heart-wood was wholly uncolored. On splitting the cylinder of wood, the vermilion was seen to have penetrated nowhere deeper than two to three millimeters, corresponding to the length of the cells in the wood employed; the rest of the wood was colorless. The microscope shows that the majority of the spring-wood cells are wholly filled with vermilion even to their lower tips; also that the bordered pits of these cells are thickly filled with vermilion, and sometimes this did not pass through into the neighboring cells which seemed to be in communication with them; there was obviously an obstruction in the bordered pits themselves. This is interpreted as showing that there still remains in the discoid markings, a thin membrane as claimed by Hartig. The autumn wood cells appeared to take up very little vermilion, and the medullary rays none. "These results confirm Hartig's and Sanio's views, that the bordered pits of the spring and a part of the autumn wood are *closed.* Nevertheless there exist at the dividing line between the autumn and spring wood passages which allow air to penetrate." The latter is shown by fastening a three to four cm. cylinder of wood from a living stem, to a bent tube holding mercury and by this means exerting a pressure of fifteen to twenty ct. If the whole is placed under water, the line between the autumnal and the spring wood will be seen to emit a circle of bubbles; but no air bubbles will escape from the first autumnal cells or the last spring cells. This experiment has been tried with the wood of the fir in January, and with *Pinus Laricio, Pinus Brutia*, and *Pinus pinsapo* in February. Both fresh and air-dry fir gave

this result; but if the wood is artificially charged with water, no air can be forced through it.

Another portion of the paper refers to the resistance which the walls of wood cells offer to filtration. If distilled water and fresh wood be used, filtration can be conducted with great rapidity. The rate diminishes after a very short time. Professor Sachs has also examined the amount of air in cell-cavities. This amount he has endeavored to determine by a series of calculations, and he gives the following results: —

Fir-stem, 100 cubic centimeters 25 cc. of cell-wall, 58.6 cc. water (in the cell cavities and imbibed by the walls), 16.4 cc. air-space. Geleznow had obtained different results, namely: 100 cc. fresh Betula alba wood contain 32.4 cc. cell-wall, 33.2 cc. water, 34.4 cc. air-space.

It may be said in conclusion that Professor Sachs has found reason for emphasizing the statement in his text-book that a distinction must be made between the passage of water through wood by means of capillarity acting in the capillary cells, and by adhesion to the cell wall. The communication will lead botanists to look with interest for the memoir of which the present short paper is only a forerunner.

ONION SMUT.[1] — Dr. Farlow's essay on this subject is of great value as well to the agriculturist as to botanical science.

The smut plant (*Urocystis Cepulæ*) makes its appearance upon the onion leaves while they are still quite young, often changing the central portion into a mass of black, dusty spores, previous to the formation of which the threads of the fungus have penetrated like a network among the cells of the leaf tissue.

It is peculiar to America, and has probably come from some of our wild species of onion. As a means of checking its ravages, which are now limited to only a few localities, the author suggests as a wise precaution, the destruction of all wild and useless species of onion. Ground on which the smut has appeared should be burned over, and the earlier in the season the better. A knowledge of allied species, supported by a limited experience of the disease in hand, tends to show that the smut spores do not retain their vitality for more than four years; therefore by growing some other crop for a few seasons a partial eradication at least might be expected.

It remains for the suffering onion growers to profit by this excellent instruction, and do all in their power to prevent the spread of the disease into new localities.

With the aid of the plate, in which are figured the plant under consideration, rye smut, and spores of the corn smut, the relations which the onion smut bears to some of the other members of the order *Ustilagineæ* are pointed out. In a note at the close of the paper the new fungus is botanically described. — B. D. H.

[1] *Onion Smut.* An essay presented by DR. W. G. FARLOW, of Harvard University, to the Massachusetts Society for Promoting Agriculture, and published with a plate in their Twenty-fourth Annual Report

SETS OF ALGÆ. — We have received the first fasciculus of Algæ Exsiccatæ Americæ Borealis, published by W. G. Farlow, C. L. Anderson, and D. C. Eaton. The present number comprises fifty species, principally from Key West and California, and is to be followed by other fasciculi, including the greater part of the marine species of the United States and some of the more interesting fresh-water algæ. The fasciculi will be of two different sizes: one of the size of Sullivant's Musci Cubenses, containing Florideæ and Chlorosporeæ, and the other of the size of ordinary herbarium sheets containing the larger Fuci, Laminariæ, etc. The price of the smaller sized fasciculus is $8.00, and of the larger, $12.00. In order to be able to include some of the rarer species in the series only a limited number of sets have been prepared, of which a few are offered for sale, and may be obtained by addressing Prof. W. G. Farlow, 6 Park Square, Boston.

SAXIFRAGA VIRGINIENSIS, *flore pleno.* — A prettier plant in its way than this double-flowered wild Saxifrage we have never seen. It was discovered by Mr. Joseph S. Adam, in Canaan, Connecticut, and is a perfectly spontaneous production, first noticed as a single plant, but is now multiplied into two or three, one of which is given to the Cambridge Botanic Garden. It is a tall specimen for the species; the stalk bearing seventy or eighty flowers; and each one bears as many petals, in a full rosette, a quarter inch in diameter, pure white. The inflorescence has the look of double-flowered *Spiræa filipendula*, or of a variety of *Cardamine pratensis*, which used to be in the gardens. The calyx is unchanged, an imperfect pistil is occasionally found in the centre; but the rest of the flower consists of petals only, in many ranks. We trust it may be preserved in cultivation. — A. GRAY.

BOTANICAL PAPERS IN RECENT PERIODICALS. — *Flora*, No. 5. Batalin. Mechanism of the Movements of Insect-Eating Plants (continued in numbers 7 and 9, but not yet finished). Dr. E. Duby, New Mosses. Dr. J. Müller, Lichens from Texas. No. 6. Dr. Scriba, A Notice of the Life of Dr. F. W. Schultz. F. Buchenau, The Cross-Section of the Capsule in the German *Junci* (with a plate giving the transverse sections of 18 species). No. 7. Dr. E. Stahl, An Explanation of Hymenialgonidia. No. 8. H. G. Holle, On the Activity of Assimilation in *Strelitzia reginæ*. (Not finished in 8 or 9.)

Botanische Zeitung. No. 11. Notice of Agardhi's *Species, Genera, et Ordines Algarum.* No. 12. R. Caspary. Remarks in regard to the Protective Sheath of Vascular Bundles. (Noticing objections to his use of the word protective-sheath (Schutzscheide.) No. 13. R. Caspary, On *Nymphæa Zanzibariensis*, n. sp. No. 14. Dr. Nowakowski, On Conjugation in some *Entomophthoræ.* No. 15. Otto Kuntze, Preliminary Report in regard to Cinchona. (Continued in No. 16.)

ZOÖLOGY.

AMPHIOXUS IN THE BERMUDAS. — It may interest the readers of The Naturalist to hear that *Amphioxus* has been discovered in the Bermudas. Mr. J. Matthew Jones and I have dredged it in the swift tide-way near the bridge at Flatts Village. The animals vary in length from three quarters of an inch to an inch and a half, and appear to be quite abundant in a belt of coarse sand in two to three fathoms of water. — G. BROWN GOODE, Hamilton, Bermuda, April 4, 1877.

THELYPHONUS GIGANTEUS POISONOUS. — Dr. H. C. Yarrow forwarded us in February, 1875, a specimen of this arachnid, with a letter from Dr. J. F. Broughter, of Fort Craig, New Mexico, in which he states his belief that this animal is poisonous, and adds, "I know the Mexicans here regard it as extremely poisonous." He incloses the following extract from a letter of Dr. Lewis C. Kennan, of Santa Fé, N. M.: —

"In regard to the *Thelyphonus giganteus*, I have *no doubt* of its venomousness; I can demonstrate the poison apparatus. While stationed at Fort Buchanan, on the border of Sonora, in 1855, I knew an Indian boy bitten on the temple who *never recovered*. Several horses were bitten on the lip, champing the insect in their hay, and the tumefaction and general distress were as great as from the bite of a rattlesnake. The insect is so extremely sluggish that great violence is necessary to make them bite. I had a French servant who frequently brought them to me in his hands and pocket, and I even suspected the omnivorous Gaul of cooking and eating them as a sort of land lobster, but they never troubled him in any way. The belief in their venomousness is universal in Mexico. To my mind the fact is beyond question. If not, what is the teleology of the fangs?"

NEW ENTOMOLOGICAL WORKS. — Bulletin, No. 2, vol. iii., of Hayden's United States Geological Survey of the Territories is a bulky pamphlet of 340 pages, containing three papers with the following titles: Western Diptera: Descriptions of New Genera and Species of Diptera from the Region West of the Mississippi, and especially from California. By C. R. Osten Sacken. Report upon the Insects collected by P. R. Uhler during the Explorations of 1875, including Monographs of the Families *Cydnidæ* and *Faldæ*, and the Hemiptera collected by A. S. Packard, Jr., M. D. By P. R. Uhler. Descriptions of the Araneæ collected in Colorado in 1875 by A. S. Packard, Jr., M. D. By T. Thorell, with an appendix by J. H. Emerton.

We may state what is not mentioned in Professor Thorell's paper, that he found several species of spiders in Colorado, closely allied to Northeastern Asiatic forms. This is confirmatory of our statement in the Monograph of the United States Geometrid Moths, that we found several Colorado moths of this family closely allied to those found on the

plateau of the Altai Mountains. Within a few days we have received a letter from Dr. Standinger, who writes, in acknowledging the receipt of a copy of the monograph, "By the excellent pictures I recognized different North American species as identical with some from Europe or North Asia, described a long time since."

CRITICISMS OF HAECKEL. — There has recently appeared a third edition of Haeckel's Anthropogenie, in which he attempts to explain man's origin in accordance with the principles of evolution. He enters into the subject in detail. He has also written a work on the General History of Creation. His agreeable style and polemical skill have secured for these books large sales, so that Haeckel's influence over the public in Germany is very great and has now extended to other countries. He has likewise propounded various theories which have demanded the attention of zoölogists. Under these circumstances it becomes a matter of especial interest to learn the opinions of competent critics. All the published criticisms by zoölogists of acknowledged high standing with which I am acquainted are unfavorable, while the praises, which the writer personally has heard, were bestowed for the most part by young persons.

Professor Haeckel's book is provided with numerous illustrations. Professor His[1] states that on page 242 of the first edition of the Schöpfungsgeschichte there are three figures, one of the egg of man, the egg of an ape, and the egg of the dog, which are referred to in the text as showing the identity of the primordial egg in mammals, but Professor His calls attention to the fact that they are electrotypes of one and the same wood-cut. On page 170 Professor His calls attention to the fact that Haeckel gives figures of an embryo dog and human fœtus, the former of which is supposed to present a copy from Bischoff, the latter from Ecker. The forehead in the dog is three and one half mm. longer than in Bischoff's figure, while that of the human embryo is two mm. shorter than the original, and made still smaller by the eye being drawn five mm. further forward, while the tail is twice as long as in the original. Professor Haeckel's figures present the closest similarity with one another.

Professor Bischoff[2] directly contradicts Haeckel's assertion that we cannot discover, even with the aid of the best microscope with the highest power, any essential difference between the egg of man and those of most of the higher mammals, and states that the pictures showing the identity of mammalian embryos in Plate V. of Haeckel's Anthropogenie differ essentially from the reality, and, finally, that the figures of apes' faces given by Haeckel on his title-page show a great agreement existing between the features of apes and of the lower human races, but that this resemblance does not appear in photographs.

[1] His Unsere Körperform. Leipzic 1875. Page 168.

[2] Sitztun. math. phys Classe der k. b. Akad der Wiss. München. 1876. Heft i., page 1.

Mr. Balfour [1] also cites Haeckel as having refigured one of his sections, employing a coloration to distinguish the layers, not founded upon Balfour's statements, but on the contrary in direct opposition to them.

Professor Hensen in his article on the Development of the Rabbit, in His and Braune's *Zeitschrift für Anatomie und Entwickelungsgeschichte*, volume i., calls attention to Haeckel's picture of spermatozoa within the yolk of a mammalian egg, a thing which no man had ever seen up to that time.

Professor Semper has openly attacked Haeckel, first in a lecture entitled Der Haeckelismus in der Zoölogie, published in Hamburg, in 1876, and again in Offener Brief an Herrn Professor Haeckel in Jena, which has just come out. In the latter especially, numerous points are noted, all telling against Haeckel: thus on page 20 he says that Haeckel's figure of a section through an annelid's head is incorrect, because it contains a cardinal vein, genital glands, liver sacks, and segmental organs, and none of these organs exist in the head; the sexual glands are drawn, too, on the dorsal side of the body, whereas they always lie on the ventral side.

Professor Haeckel further makes statements of fact: one of these is that Goethe was an evolutionist. Kossmann, in a pamphlet which I have not at hand, has reviewed the citations from Goethe, and concludes that Haeckel's assertion is false. Oscar Schmidt [2] draws the same conclusion.

Semper in his Offener Brief, page 11, affirms that Haeckel's view that the Echinoderms are formed by worm colonies is belied by the facts of anatomy and embryology.

Mecznikow, F. E. Schulze, Oscar Schmidt, and Barrois in their recent investigations on the sponges have questioned the accuracy of Haeckel's observations on the embryology of these animals. But this subject is not thoroughly worked up yet, and Haeckel may be right after all; but we pass to other criticisms.

Mr. Alexander Agassiz [3] condemns the "startling hypothesis of the genetic connection between the Geryonidæ and Æginidæ, . . . called by Haeckel allæogenesis," and propounded in his memoir on the Rüsselquallen. Agassiz adds that two short papers, recently published by Schulze and Ulianin, prove conclusively that "Haeckel's theory, like so many other of his vagaries, had no foundation in truth. It was based not merely on an incorrect interpretation of facts, but the facts themselves existed only in his imagination. As perhaps, with the exception of his monograph of the Radiolaria, no other memoir has contributed more than the one above quoted to give Haeckel the position he holds among zoölogists, we may be allowed to remind the Haeckelian school of nat-

[1] Journal of Anatomy and Physiology, vol. x, page 521, note.

[2] Deutsche Rundschau. O. Schmidt. April, 1876, page 95.

[3] Silliman's Journal. May, 1876, page 420.

uralists that this same genetic connection has furnished the text for many a sermon from their high priest. Infallible himself, he has been unsparing in his condemnation of the ignorance and shallowness of his opponents. Proved now to be in the wrong, we expect, therefore, justice without mercy from this stern scientific critic, and look forward in the next number of the *Jenaische Zeitschrift* for a thorough castigation of Haeckel by Haeckel, showing up the absurdity of allæogenesis and all that hangs thereby."

Finally, Professor Haeckel has proposed various theories. The most widely known of these is his Gastræa-Theorie. The inspiration of this was the theory of the germinal layers being homologous in all classes of animals. Do not let us confuse matters, but remember that this theory was suggested by Von Baer [1] in 1828, and by Rathke half a century ago. It was brought prominently forward by Kleinenberg in his memoir on Hydra, and then further established by Mecznikow and Kowalewsky, and since by numerous observers.

The Gastræa-Theorie is an attempt to explain these homologies. Claus [2] proves that this is unsuccessfully tried, because it disagrees with the facts in many cases. He further points out that Haeckel has contradicted himself several times flatly in his system of classification.

Haeckel has proposed a biogenetical fundamental law (biogenetisches Grundgesetz), namely, that embryology is the repetition of phylogeny. This is merely a misshapen repetition of the principle taught by Agassiz, that the embryos of higher animals resemble the adults of lower forms. Kölliker [3] demonstrates the falsity of Haeckel's mode of stating the case by noticing some of the conclusions he draws, but which are disproved by facts.

It does not seem to me desirable to continue these quotations and references, for I think that the inaccuracy of Haeckel's pictures, of his statements of facts, and finally of his theories, has been sufficiently indicated. I close with a quotation from Professor His's Unsere Körperform, page 171: —

"I myself have grown up in the faith that among all the qualifications of a naturalist, the only one which cannot be spared is accuracy and an unconditional respect for the truth. At present, also, I still hold the view that the absence of this one qualification tarnishes all others, may they be never so brilliant. Others may, therefore, admire Mr. Haeckel as an active and relentless party leader; in my judgment he has, by his very manner of attack, resigned his right to be reckoned an equal in the circle of serious investigators." — CHARLES SEDGWICK MINOT.

[We should not lose sight of the fact that Haeckel stands as an original investigator far above some of his critics. He has established a dis-

[1] Uber Entwickelungsgeschichte der Thiere. Theil I., page 245.
[2] Die Typenlehre und E. Haeckel's sog. Gastræa-Theorie. Vienna, 1874.
[3] Entwickelungsgeschichte. 2te Aufl, page 392.

tinct school in biology. His works on the Monera, the Rhizopoda, the Sponges, Infusoria, Acalephs, etc., besides his masterly drawings and elegant literary style, should be taken into account in judging of his influence on the progress of zoölogy. — Ed. Naturalist.]

Notes on the Beaver. — Along the banks of the Grand River, Northwestern Colorado, in the year 1874, I had an opportunity of examining the work of a colony of beavers. I was first apprised of the vicinity of these animals by noticing a timber-shoot or clearing scooped out from the willow-brake to the edge of the water. It had the appearance of having been recently used, and the dragging of the logs had hollowed out the channel down to the brink of the stream. Through this slide I passed into a grove composed of slender willows which formed an almost impenetrable thicket. About fifty feet from the river was a circular clearing where the animals had been at work. Here the trees were larger, and many of them had been cut off obliquely within six inches of the ground, almost as nicely as though done with a steel axe. The logs had been hauled away, leaving an opening in the dense thicket. Farther on, larger trees had been felled which were still remaining, the majority of them measuring six and eight inches in diameter, and one tree, which had been completely severed, measured at least fourteen inches. The wood had been gnawed around the circumference, a few inches from the base, the deepest cutting having been done on the side next the water, so that the tree might fall in that direction. A few, however, had been felled so as to fall away from the river, which fact serves to show that these animals are endowed with an instinctive sagacity nearly approaching reason; for if they were guided merely by ordinary animal instinct, no mistakes would be made. Does not the bird build her nest as perfectly the first time as after years of practice? On the contrary, the beaver seems to be benefited by experience, and just as man arrives at proficiency through his mistakes the beaver profits by his errors. I noticed that wherever there were trees which had been felled some time past and fallen in the wrong direction, the newer work had been accomplished, without exception, in a systematic manner, all of the logs being cut so as to fall toward the dam. As I passed along the bank of the stream, I observed about ten timber-shoots, running parallel, at right angles to the course of the current, and separated by about fifteen feet. The larger trees had been cut near the water and above the dam for the purpose of floating them down, to save the labor of dragging from the interior. I must have interrupted them at their work, as some of the cutting was perfectly fresh, and large, damp chips lay profusely around trees which had not been entirely severed. In one place where a tree had been cut almost through, water was dripping from the notch, showing where a beaver had just been at work. I picked up several chunks of wood, six or eight inches in diameter and about as much in length, the ends being obliquely parallel.

These had probably been prepared to fill up chinks in the walls of the dam. The trees had been, for the most part, cut into sections averaging ten feet in length, and the branches and twigs had been trimmed off as cleanly as a wood-chopper could have cut them. Along the banks of the White River, some weeks before, I noticed several artificial canals which had been dug out in the absence of natural side-channels in the river. These were designed for floating down logs. One canal was four feet in width, seven in length, and several feet deep. — E. A. Barber.

ANTHROPOLOGY.

Cremation among the Sitka Indians. — During the writer's residence at Sitka, the capital of Alaska Territory, he had the opportunity of witnessing the interesting ceremony of cremation as performed by the Sitka Indians.

The subject of this solemn rite was the dead body of an old squaw, who was the mother of a numerous progeny. The day fixed for its consummation was the one immediately succeeding her death. About nine o'clock on the morning in question, four of us filed through the wooden stockade that separates the town of Sitka from the Indian village. After threading our way for some distance among the rocks along the beach, and through the filth which invariably surrounds an Indian habitation, we at length reached the dwelling-place of the deceased. As we approached we were greeted by the barking of a dozen or more wolfish-looking dogs. The hut was a substantial one, built of logs so carefully hewn that one could scarcely believe that their smooth surface was not due to the plane of a carpenter. The roof was formed of long, thin slabs, split from spruce or cedar trees, and had but a slight pitch. Immediately over the centre of the house a large rectangular hole was cut in the roof to give egress to the smoke arising from the fire within. To prevent the snow and rain from descending through this opening, a short ridge-pole, held up by two small forks which were fastened, one at each end of the hole, to the main ridge-pole, supported a covering of long slabs whose lower ends rested upon the main roof, while the upper ones projected far enough to screen the interior in a great measure from the uncomfortable effects of the driving storms.

The only entrance was through a circular hole about two feet in diameter, placed about six feet above the ground, and reached by half a dozen steps. Through this hole we had to crawl on our hands and knees, and by a corresponding descent on the inside we reached the floor, which was also made of slabs laid upon the ground, except a place about eight feet cut in the middle where the fire is built.

At the end opposite the door was erected a kind of closet, arranged with shelves, upon which were stored the winter supplies of smoked salmon, seal oil, and dried berries, together with the usual stock of blankets and peltries.

In one corner of the room we found the corpse, completely incased in blankets, which in turn were enveloped by a large, woven sea-grass mat, and tied up in such a manner as to bring the knees nearly to the chin, and thus enshrouded it was placed in a sitting posture. The house was about half-filled with Indians, — men, women, and children.

On one side of the room a young brave was busily engaged with a pair of scissors in cutting off the long black hair of all the near relatives, both male and female. This seems to be one of the usual mourning customs among these Indians. After he had completed this tonsorial duty, during which he had been frequently interrupted by their sudden outbursts of grief, a procession of about twenty Indian warriors, headed by old An-a-hoots, the war chief of the tribe, filed slowly through the small portal. Each carried in his hand a long slender staff made of hard wood and carved all over with fantastic figures, while bright-colored Hudson Bay blankets fell in not ungraceful folds from their broad, square shoulders. These staves bore evidence of their great age by the high polish they possessed, as well as by their smoky color and pungent odor. The warriors ranged themselves in line along one side of the house, facing the centre, and immediately began a lugubrious death chant, keeping time by raising their staves about three inches from the floor, and letting them fall together. This doleful air was much more monotonous than musical.

All this time the relatives of the deceased were rending the air with their lamentations. Every Indian present had his face thickly smeared with a fresh coat of seal oil and black paint, thus rendering himself almost inconceivably hideous.

At the close of the death song two stalwart young braves mounted to the roof and lowered bark ropes through the aperture, which were made fast to the matting that enveloped the corpse. An-a-hoots made a sign to the young men, and they began raising the body toward the opening in the roof. They always remove their dead from their houses in this manner instead of through the door, on account of a superstition they have that the spirit of the defunct made its exit in this way. But just as it arrived at the roof one of the ropes broke, precipitating the lifeless bundle upon the fire below, scattering the burning coals in every direction. For a moment all was terror, confusion, and dismay. The shrieks and yells of superstitious horror that went up from the women and children baffle description. The body was hastily snatched from the fire and hurriedly carried out through the door to the funeral pile, which was about forty yards in the rear of the house. No second attempt was made to take it through the hole in the roof, as they thought the old woman's spirit was angry and did not desire it. All the coals and ashes upon which the body had fallen were then hastily scraped up with pieces of bark by the young squaws, carried out and thrown into the sea, for fear they might bring down unheard-of evils upon the heads of the living inmates of the house.

The pyre was built of cedar logs. The foundation consisted of two logs about five feet long and ten inches in diameter, laid parallel to each other, and about two feet apart. Upon these was placed transversely a layer of shorter logs of a less diameter, with interstices between them through which the flames could penetrate from below. This base was surmounted by a small superstructure of cedar crib-work, large enough to contain the corpse and its mortuary habiliments. Into this the remains were placed and covered with small sticks of wood. Near the windward side of this pile were laid two boards, along which were ranged the singing warriors; the only office of these boards appeared to be that of furnishing a hard, resonant surface upon which the staves they used to indicate the measure of their chant could fall. Close by the crib was a pile of spruce and cedar, finely split, in order that it might burn more rapidly. The mourning relatives were seated on the ground with their backs turned toward the pyre, and about thirty feet distant. At last the torch was applied to the resinous tinder, the warriors began anew their melancholy dirge, the mourners, whose loud lamentations had before sunk to a low sobbing, now broke forth afresh into heart-rending wails. Several hours were occupied in the entire consumption of the pile, during which the chanting never ceased, but after a time the outward grief of the bereaved was confined to weeping and subdued sobs. When the fire had died out the remaining ashes and cinders were carefully collected and laid in their final resting-place.

The cinerary urn consisted of a small house built after the model of their huts, being about three feet long by two feet wide, and two high, and placed about ten or twelve feet above the ground on four posts. These dead houses are often carved and painted on the exterior in the most cabalistic manner. It was formerly the custom among these Indians to kill a number of slaves upon the occasion of the death of one of their tribe, but the military authorities of the United States have suppressed the barbarous practice since their occupation of the territory. These slaves are prisoners of war, taken from other tribes, and their bondage is hereditary. The number of slaves sacrificed depended upon the rank of the deceased.

GEOLOGY AND PALÆONTOLOGY.

SCUDDER ON FOSSIL INSECTS FROM BRITISH COLUMBIA. — A small number of fossil insects obtained by Prof. G. M. Dawson in British Columbia, from tertiary beds, have been described by Mr. Scudder in the Report of Progress for 1875–76 of the Geological Survey of Canada. The specimens are better preserved, as a general rule, than any that have been obtained from other American localities. Besides fragmentary indeterminate remains not mentioned, there are twenty-four species or more which can at least be referred to families. Beetles were, with but one exception, absent from the collection, which consisted of Hymenop-

tera (ants and ichneumons) and two-winged flies, a nitidulid beetle, a plant-louse, and a dragon fly.

BRAIN OF CORYPHODON. — In the last NATURALIST, page 312, is an abstract sent by Professor Cope, which purports to announce important discoveries recently made by himself in regard to the brain of *Coryphodon.* Reference is made to the brain of *Dinoceras* (or *Uintatherium*), and a new classification is proposed based on these discoveries. It may interest the readers of the NATURALIST to know, first, that the brain-case of *Coryphodon* was described and figured by the writer a year ago (*American Journal of Science*, vol. xi., page 426, May, 1876), and that this fact was well known to Professor Cope, although he makes no reference to it. Second, the account of the *Coryphodon* brain, given by Professor Cope, so far as it differs from my description, is not correct, and shows that he has made a most serious mistake in his observations. Third, his statements in regard to the brain of *Dinoceras* are directly refuted by a series of well-preserved specimens. Fourth, the classification based on these alleged discoveries is untenable, as the known facts are against it.

I deem it especially necessary to make these corrections, since Professor Cope has recently sent to the NATURALIST several other communications quite as incorrect as the present abstract. — O. C. MARSH.

GEOGRAPHY AND EXPLORATION.

GEOGRAPHICAL NEWS. — Herr Barth, the German explorer, surveying possessions in Africa for the government of Portugal, committed suicide in Loando while delirious with fever. Herr Mohr, another German explorer of the expedition, searching for the sources of the Congo River, is dead.

After an absence of two years in the interior of Africa, Colonel Gordon reached Cairo on his way back to England on the 1st of last December. The task assigned him was the opening of a practicable commercial highway from that city to the Albert and Victoria lakes. Sir Samuel Baker, who preceded him, had been compelled to fight his way back from the extreme point reached in the interior of Gondokoro, and had left the newly explored country in a disturbed state. Colonel Gordon has succeeded in pacifying the hostile tribes, and has established a line of posts, fifty to one hundred miles apart, from Khartoum to Gondokoro, and thence to the Albert Lake. The communication was so far perfected that English papers were received with tolerable regularity in seven weeks from their date of publication,

Four maps of the Nile from sketch surveys of General Gordon have been published in the third number of the Bulletin of the Egyptian Geographical Society. These are reproduced on a reduced scale and on a single sheet in Markham's Geographical Magazine for March. Mr. E. G. Ravenstein announces in the same magazine that he has received

from General Stone, the chief of the Egyptian staff, a map of the Nile between Dafli and the Albert Nyanza, based upon a reconnaissance made by Gordon Pasha in July, 1876. The map differs from that published previously in several respects. There is no indication now of an arm of the river flowing towards the northwest.

The Portuguese appear to exhibit an unwonted activity in connection with their African settlement. On the west coast they claim the exclusive navigation of the Congo and are charged with the design of desiring to appropriate Ambrizette, Landama, and Bandana.

At a late meeting of the Geographical Society of Paris, Mr. D. H. T. Mosse, of San Francisco, in criticising Captain Rondaire's scheme of creating an inland lake to the south of Algeria, said that the displacement of the water required to fill this lake of 6250 square miles would result in a shifting of the earth's axis! Captain Cameron gave in French at the meeting of the same society January 26th an account of his explorations. He was frequently interrupted by applause, and before separating the president announced that the gold medal of the society had been awarded to the intrepid explorer. On the 27th he was entertained at a dinner, where the bill of fare included fillet of venison *à la Kassongo*, and lobsters *à l'Africaine*.

At a recent meeting of the Geographical Society of Lyons, M. Dufonchel explained his scheme of a Saharan railway, which was to connect Algeria with Timbuktu. The Sudan had no less than fifty millions of inhabitants and a climate equal to that of Bengal or Brazil. The sands of the Sahara, it was said, would overwhelm the proposed railway, but the same thing had been said about the Suez canal, and this difficulty could be overcome by engineers. Artesian wells would furnish an ample supply of water.

At the meeting of the Geographical Society of Paris, M. Violet d'Aoust read a paper on the mountain systems of Central America and the dust whirlwinds observed by him on the plains of Mexico.

A resolution has been adopted by Congress requesting the Secretary of the Navy to transmit to the Senate the narrative of the second expedition of Captain Hall to the Arctic regions, to be compiled from notes of the expedition made by Captain Hall and purchased from his widow.

LUDLOW'S RECONNAISSANCE IN MONTANA.[1] — The route traveled by Captain Ludlow's party was an interesting one, and the account of the brief trip through the Yellowstone National Park, accompanied as it is by a map, will be valuable and authoritative to intending tourists. Mr. George B. Grinnell contributes a report on the mammals and birds, while a geological report by Edward S. Dana and Mr. Grinnell includes

[1] *Report of a Reconnaissance from Carroll, Montana Territory, on the Upper Missouri, to the Yellowstone National Park and Return, made in the Summer of* 1875. By WILLIAM LUDLOW, Capt. Engineers U. S. A. Washington, 1876. 4to, pp. 155. With three maps and two plates.

some account of the Little Rocky Mountains, a region lying north of the main route of the party. The description of new fossils, by R. P. Whitfield, is accompanied by two plates.

Recent Geographical Progress. — First and foremost we have to mention the numerous scientific congresses: the periodical sessions of the International Congress of Geographical Sciences inaugurated at Antwerp, in 1871, and continued at Paris, in 1875; the periodical sessions of the International Geodetic Association, the last session of which was held at Bruxelles, in October, 1876; the Statistical and Prehistorical Congresses at Buda-Pesth, the Congress of Orientalists at St. Petersburg, and that of Anthropologists at Jena; and, further, the creation, since 1870, of numerous geographical societies, to wit: in 1870, at Bremen; 1872, at Buda-Pesth; 1873, at Halle, Kiew, Hamburg, Bern, Amsterdam, Lyons, and Paris (Society of Commercial Geography); in 1874, at Bordeaux (Society of Commercial Geography); in 1875, at Cairo, Bukarest, and Lisbon; in 1876, at Madrid, Marseilles, at Paris (Topographical Society), at Bruxelles and at Antwerp; finally, the International Association for the purpose of suppressing the slave trade and exploring Central Africa, due to the high initiative taken by H. M. King Leopold II., and constituted at Bruxelles, September, 1876. — Bulletin No. 1, Geographical Society of Belgium.

MICROSCOPY.

Fossil Diatoms from South Australia. — Mr. Galloway C. Morris, of East Tulpehocken Street, Germantown, Philadelphia, obtained from the commissioner in charge of the South Australian exhibit at the Centennial a small supply of a most interesting diatomaceous mineral called coorongite, from the Coorong District, in South Australia, where it is found. It is a mineral of a dark-gray or ash color, a light specific gravity, and a fine spongy texture, occurring in great quantities, and consisting of about twenty per cent. of a hydrocarbon which can be separated by distillation for economical purposes as an illuminating and lubricating oil, and a residue consisting mainly of fresh-water diatoms. It burns when heated on platinum foil, is permanent in the air, and is unaffected by moisture. It is not disintegrated in ether or chloroform, though most of the oily hydrocarbon is removed. Mr. Morris has succeeded best in preparing it for the microscope by boiling it in sulphuric acid with the addition of a small quantity of bichromate of potash to make chromic acid and give off the hydrocarbon as carbonic-acid gas. He has a few slides to spare, which he is willing to exchange for other mounted specimens.

Annual Reception. — The American Microscopical Society of the city of New York held a very successful invitation exhibition at Kurtz's art gallery, Madison Square, on Tuesday evening, March 6th.

Diphtheria. — This subject has been discussed at recent meetings

of the San Francisco Microscopical Society. Dr. A. M. Edwards, who was present as a visitor, introduced the subject, describing the growth and development of the fungoid growth which is observed in connection with the disease. He confidently believed that diphtheria is at first a local disease, caused and spread by the growth of these organisms, and that salicylic acid applied in the form of spray is capable of positively arresting the disease by destroying the organisms which caused it. He believed the microscope, especially by its moderately high powers, to be the only instrument able to decide this question, and that its revelations fully sustained the theory of fungoid growths as a cause of the malady. Dr. S. M. Mouser, a member of the society, contended that the membrane was an exudation consisting of epithelial cells in various stages of formation and disintegration, mucous and pus corpuscles, and spindle-shaped bodies distributed with some regularity, indicating organization of some kind, and regarded as fibre cells or smooth muscular fibres. He had not been able to detect anything that was certainly of a fungoid character. Dr. S. Laycock, of Edinburgh, had conceived the idea in 1858 that this disease was caused by a parasitic fungus, and the theory had been revived in Germany a few years ago, and salicylic acid used to destroy the fungus, but that treatment had now been abandoned, and the local application of warm water and steam substituted for it. Aitkin, Beale, and others have considered the fungoid growths to be only accidentally present, and not a cause of the disease. The speaker believed it to be the generally received opinion of the medical profession at present that the disease is constitutional in its character, and that this theory is not disproved by microscopical observation.

PERSONAL. — Wm. H. Walmsley, one of the best-known cultivators of microscopy in this country, retired on the first of April from the firm of Jas. W. Queen & Co., of Philadelphia. After the completion of his present European trip he expects to be able to open an American branch of "R. & J. Beck," with such a stock and at such prices as were never before seen in this country. In his new enterprise he will at least have the good will of all who have had previous dealings with him, which probably includes nearly all our microscopists.

ROCK SECTIONS. — Alexis A. Julien, of the School of Mines, Columbia College, 50th Street and 4th Avenue, New York City, is preparing to order microscopic sections of rocks, minerals, and other hard substances, and intends shortly to keep on hand series of sections of American rocks and minerals. The sections are prepared with care and judgment, and at a cost of sixty cents each except for specially large or difficult objects. If so ordered they will be mounted on the standard plate glass slides 3x1 inch, but this size is not advised on account of their thickness, $\frac{1}{16}$ inch, preventing proper illumination under high powers by achromatic condenser, inconvenient length preventing ready rotation on small stages, liability to fracture, etc. Thinner plate glass slides ($\frac{3}{64}$ to

$\frac{1}{32}$ inch) are preferred, of the size adopted by Fuess of Berlin ($1\frac{25}{32}$ by $1\frac{1}{16}$ inch), and these, with covers of medium thinness and $\frac{7}{8}$ inch square, will be used unless otherwise ordered.

A NEW STUDENTS' MICROSCOPE. — The increasing importance of cheap and portable microscopes, and the increasing demand for good instruments specially adapted to work in histology and pathology, has lately led all our prominent makers to introduce so-called students' microscopes of excellent quality and remarkable cheapness. The latest work of this kind is the new students' microscope of Mr. Joseph Zentmayer, of 147 South Fourth St., Philadelphia. This stand is a truly American model, in which the standard English and continental styles which have served as models so long, are nearly lost sight of, and the recent very important contrivances of Mr. Zentmayer are introduced almost as effectively as in his superb first class stand. The base and hollow upright column are cast in one piece, giving great lightness and firmness combined. The mirrors and substage, together, swing around the object, so that it can be readily kept in focus of the illuminating apparatus at any desired angle; and the bar can be swung so as to carry the whole illuminating apparatus above the stage for opaque objects. There is a good substage which can easily be removed entirely when desired. The stage is thin and beveled, so that extreme obliquity of illumination can be obtained by simply turning the stand or swinging the mirror. The diaphragms are mounted on the substage, and can be brought up close to the object-slide if desired. The coarse adjustment is by a sliding tube, and the fine adjustment by a screw and lever moving the whole body on a long sliding support exactly like that of the rack movement in the common Jackson stands. The stage is only three inches from the table, and the tube is correspondingly short, though capable of lengthening by draw-tube to the standard length. The whole stand is a marvel of neatness, compactness, stability, and convenience. At the request of the writer, a stand has been made with a specially adapted achromatic condenser and with a thin concentrically revolving stage like the diatom stage of the maker's "centennial" stand, which is worthy of being furnished with the highest class objectives and is capable of doing almost anything that the most elaborate stands can do.

PRACTICAL MICROSCOPY. — Rev. E. C. Bolles, an unsurpassed lecturer on the subject, has consented to give instruction in microscopy at the second session of the summer school of biology, which will be opened at the Museum of the Peabody Academy of Science, at Salem, Mass., on the 7th of July next. The term lasts seven weeks. A course of lectures and demonstrations on Animal Histology, will also be given by Mr. C. S. Minot. The admission fee is $15.00.

BOSTON MICROSCOPICAL SOCIETY. — This society held its second annual reception on Friday evening, April 27, with a programme of re-

marks by Prof. Oliver Wendell Holmes, a screen exhibition of Polariscope objects, by Rev. E. C. Bolles, and an exhibition of objects under about sixty microscopes by members of the society. The society has recently rented and furnished rooms at 29 Pemberton Square, and is working with perseverance and increasing success to unite and assist those, within its reach, who are interested in microscopical study.

SCIENTIFIC NEWS.

— The interest in geographical research continues to increase in France from year to year. The Société de Geographie of Lyons has published six numbers of its Bulletin, all full of interesting matter. A handsome volume has just been printed by this society entitled A Geographical and Statistical Study of the Production and Commerce of Cocoon Silk, by Leon Clugnet. This memoir was crowned by the Geographical Society. The president of the society is desirous of coöperating with geographers of foreign countries in popularizing the study of geography. He proposes a place for exhibiting in public places the most important geographical statistics of any desired region so that the people may read them at all times, and thus become familiar with them. The first number of the Bulletin of the Société Belgée de Geographie, published at Brussels, has just appeared. The leading article by the president, General Liagre, on Geographical Science, is one of great interest. There are seven articles with maps in this number, and a long list of members actual, honorary, and corresponding. The objects of the society, as laid down in the Bulletin, are exceedingly comprehensive, embracing every possible form of geographical information.

— The first number of the third volume of Hayden's Bulletin of the United States Geological Surveys of the Territories is rich in articles relating to the anthropology and archæology of the West, as may be seen by the following table of contents: A Calendar of the Dakota Nation, by Bvt. Lt. Col. Garrick Mallery, U. S. A. (Plate 1.) Researches in the Kjökkenmöddings and Graves of a Former Population of the Coast of Oregon, by Paul Schumacher. (Plates 2–8.) Researches in the Kjökkenmöddings of a Former Population of the Santa Barbara Islands and Adjacent Mainland, by Paul Schumacher. (Plates 9–22.) The Twana Indians of the Skokomish Reservation in Washington Territory, by Rev. M. Eells. (Plates 23–25.) Notes on a Collection of Noctuid Moths made in Colorado, in 1875, by Dr. A. S. Packard, Jr., by Aug. R. Grote. The Tineina of Colorado, by V. T. Chambers. Notes on a Collection of Tineid Moths made in Colorado, in 1875, by A. S. Packard, Jr., by V. T. Chambers. On the Distribution of Tineina in Colorado, by V. T. Chambers. New Entomostraca from Colorado, by V. T. Chambers. On a New Cave Fauna in Utah, by A. S. Packard, Jr., M. D. Description of New Phyllopod Crustacea from the West, by A. S. Packard,

Jr., M. D. On some Artesian Borings along the Line of the Union Pacific Railroad in Wyoming Territory, by F. V. Hayden. (Plate 26.)

— One of the best organized and probably the most active geological surveys in Europe is the Imperial Geological Institute at Vienna. From recent letters received from Count Marschall by Professor F. V. Hayden we glean the following items of interest: During 1876 great progress was made in the field operations in Austria and Bohemia, as well as in Southern Tyrol, Eastern Galicia, the southernmost region of the Carpathian Mountains of Galicia, and in the Triassic and Jurassic regions of the eastern Alps. Different members of the survey have made excursions to Denmark, Sweden, Northern Italy, Southern Russia (Odessa), Sicily, European Turkey, and Greece and Egypt, aided by subsidies from the government, which has most liberally encouraged the comparative study of the geology of its own empire by researches in other lands.

— The Army Signal Office has for some time past been publishing a Monthly Weather Review, in which are collected together many facts relating to the climate of the United States, which have a direct bearing upon the distribution of animal and vegetable life. We purpose from month to month to extract some of the interesting items given in this review, but must refer our readers for full information to the original which is published about the middle of each month, and quite freely distributed by the Weather Bureau at Washington.

During March, twelve areas of high pressure and twelve of low have passed over the country; all of the latter were accompanied by rain, and most of them by high winds; the most severe storm of the month was that which began on the 21st, west of the Missouri River, and disappeared on the 31st, east of Newfoundland. The month has been warmer than usual throughout the Atlantic and Pacific States, but was slightly cooler in the St. Lawrence Valley, the Lake region, Ohio, and the north west. A large excess of rain and snow fell in the lower Lake region, the St. Lawrence Valley and New England, as compared with the average for many years; a deficiency was reported from the western Gulf States, and the northwest. The temperature of the water is observed in numerous rivers and harbors, and appears to have been quite generally lower than in March of last year for the Mississippi and its tributaries, but higher along the middle and east Atlantic coasts. The chapter on Miscellaneous Phenomena contains a large number of zoölogical and botanical notes relating to the advent of spring and the birds and insects of the season. The migrations of birds are carefully reported; grasshoppers are reported as destructive in Texas, hatching in Florida, and beginning to hatch in Ohio and Kansas.

— Brehm's well-known Thierleben, a large, beautifully illustrated popular work on animals, which for many years has been the leading work of the kind in Germany, is now passing through a new edition,

enlarged, with numerous full-page illustrations and exquisite wood-cuts drawn by Kretschmer, Mützel, and Schmidt. The work is to be published in from forty to forty-five parts, of which ten have been received in this country, a part being issued every week or fortnight. The work has received the notice and praise of Darwin, Carus, Dr. Petermann, Von Tschudi, and Dr. Rohlfs. The subscription price in Germany is one mark (or about twenty-five cents). The agents for the United States are B. Westermann & Co., 524 Broadway, New York.

PROCEEDINGS OF SOCIETIES.

NATIONAL ACADEMY OF SCIENCES. Washington, April 17–20. — The following new members were elected: Elliott Coues, U. S. A., Washington, D. C.; J. W. Draper, New York; Henry Draper, New York; S. H. Scudder, Cambridge, Mass.; C. S. Peirce, Cambridge, Mass. Following are the titles of the papers on natural science: On the Young Stages of some Osseous Fishes, the Results of Deep-Sea Dredgings, by Alexander Agassiz; On Critical Periods in the History of the Earth, and their Relations to Evolution, and on the Quarternary at such a Period; On the Structure of the Crystalline Lens and its Relative Periscopism, by Joseph Le Conte; On the Structure of the Henry Mountains, by G. K. Gilbert; On the Public Domain, by J. W. Powell; Remarks on some Artesian Wells along the Line of the Union Pacific Railroad in Wyoming Territory, by F. V. Hayden.

AMERICAN PHILOSOPHICAL SOCIETY. Philadelphia, January 5, 1877. — Mr. Britton exhibited specimens of artificial fuel manufactured from the peat-bogs near Syracuse, New York, and remarked its resemblance to the lignite of southwest Arkansas. Professor Lesley read characteristic portions of a paper by Mr. Lesquereux, introductory to the Flora of the Carboniferous of North America, now in preparation for the Report of Progress of the Second Geological Survey of Pennsylvania.

January 19, 1877. — Professor Lesley presented a paper on the first systematic collection and discussion of the Venango Company Oil Wells of Western Pensylvania, by E. S. Nettleton, C. E. General Kane read a description of his recent explorations in Coahuila, exhibiting photographs of Mexicans and describing the migrations of Indians.

February 2, 1877. — Professor Cope exhibited some fragmentary crania of *Dinosauria* from the Judith River beds of Montana, and described their structural and systematic characters. He also read a paper entitled A Continuation of Researches among the Batrachia of the Coal Measures of Ohio.

February 10, 1877. — The secretary read a paper by Alexander E. Outerbridge, Jr., on the Wonderful Divisibility of Metallic Gold. Professor Lesley read a communication entitled, A Measured Section of the Palæozoic Rocks of Central Pennsylvania from the Top of the Alle-

ghany River Coal Series (on the Broad Top) down to the Trenton Limestone in the Lower or Cambro-Silurian System, by Chas. A. Ashburner. General Kane resumed the reading of his paper on the ethnological movements taking place in Northern Mexico. Professor Cope exhibited and described fragments of the fossilized skeleton of a gigantic Dinosaurian, found by Prof. J. S. Newberry, in Painted Cañon in southeastern Utah, when acting as geologist to the expedition across New Mexico to the Junction of the Green and Grand rivers under Captain McComb, U. S. A. This fossil was derived from supposed Triassic beds, and was named *Dystrophæus viæmalæ.* Professor Cope exhibited drawings of supposed Indian sculptures in the form of a dial or zodiac, said to have been recently discovered near Davenport, Iowa, in an Indian mound.

March 2, 1877. — Professor Cope exhibited the fossil skeletons of two species of *Elasmosaurus* from the cretaceous formations of the West. One of these measuring thirty-five feet in length, from the Niobrara Cretaceous of Nebraska, was regarded as representing a new species and was called *E. serpentinus.* The other, represented by seventy-six vertebra from the Fort Pierre group of Montana, was identified with the *E. orientalis,* of New Jersey. Professor Cope read a description of a new form of Proboscidian allied to *Dinotherium* and *Mastodon,* which he called *Cœnobasileus tremontigerus.*

March 10, 1877. — Professor Lesley communicated a paper entitled Notes on the Results of the Survey of the Iron Ore Beds of the Juniata District of the Geological Survey of Pennsylvania, by J. W. Dewees. Professor Cope exhibited the cast of the brain cavity of the *Coryphodon elephantopus* from the Wasatch Eocene of New Mexico, derived from the collections made by Lieut. G. M. Wheeler, U. S. A., and described its characters, which led him to the conclusion that the *Amblypoda* should be referred with the *Bunotheria* to a distinct sub-class of the Mammalia, which he called the *Protencephala.* He stated that the brains of the following genera conformed to this type: *Coryphodon, Uintatherium, Oxyæna, Arctocyon.*

April 6, 1877. — The secretary communicated for Dr. D. G. Brinton a paper on the Timucua Language, by Albert S. Gatschet. The secretary read a communication from Mr. C. E. Hall describing the late discoveries of *Eurypterus* in northwestern Pennsylvania by Messrs. Carll and Mansfield.

April 20, 1877. — Mr. Britton read a paper on the value of pressed peat as an article of fuel. Professor Frazer presented a paper on the cause of the northwest dip of the Mesozoic rocks in Eastern Pennsylvania, and on the origin of the magnetic and specular iron ore banks in the Mesozoic and Azoic rocks of the same region.

May 4, 1877. — Professor Cope read a paper on the structure of the brain in *Procamelus* as derived from a cast of the cavity of a skull obtained by himself near Santa Fé, while on Lieut. G. M. Wheeler's

surveying expedition. He also read a paper entitled A Synopsis of the cold blooded Vertebrata obtained by Prof. Jas. Orton in Peru, during the explorations of 1876–77. A number of species were described from the high valleys of the Andes, from 10,000 to 14,500 feet altitude.

SCIENTIFIC SERIALS.[1]

MONTHLY MICROSCOPICAL JOURNAL. — April. Additional Note on the Identity of *Navicula crassinervis*, *Frustulia saxonica*, and *N. rhomboides*, by W. H. Dallinger. The Exhibitor; a novel Apparatus for showing Diatoms, etc., by S. G. Osborne. On the Phytoptus of the Vine, by G. Briosi. A Mode of altering the Focus of a Microscope without altering the Position of either the Objective or the Object, by M. Gori.

THE GEOLOGICAL MAGAZINE. — April. What is a Brachiopod? by T. Davidson. Notes on the Geology of the Lebanon, by E. R. Lewis. Ettinshausen's Theory of Development of Vegetation on the Earth.

ANNALES DES SCIENCES NATURELLES. — February 15th. Anatomie de la Moule commune (*Mytilus edulis*), par A. Sabatier. (Nine Plates.)

ANNALS AND MAGAZINE OF NATURAL HISTORY. — April. On the Distribution of Birds in North Russia, by J. A. H. Brown. Description of some Sponges obtained during a Cruise of the Steam Yacht "Argo" in the Caribbean and Neighboring Seas, by T. Higgin. Hermaphroditism in the parasitic Isopoda, Further Remarks on Mr. Bullar's Papers on the above subject, by H. N. Moseley.

ARCHIV FÜR NATURGESCHICHTE. — Jahrgang 43, Heft 1. Ueber den Bau des Bojanus' schen Organes der Teichmuschel, von H. A. Griesbach. Ueber das Eierlegen einiger Locustiden, von Dr. Bertkau.

POPULAR SCIENCE REVIEW. — London, April. Evidences of the Age of Ice, by H. Woodward. On the Desmids and Diatoms simple Cells, by G. C. Wallich. The Norwegian Lemming and its Migrations, by W. D. Crotch. The Alkaline and Boracic Lakes of California, by J. A. Phillips.

APPALACHIA. — March. Geology of the White Mountains (with Map of the White Mountain District, showing Locations of specimens and contour Lines for each 500 feet above the sea), by C. H. Hitchcock. Carter Dome and Vicinity, by W. G. Nowell. Distant Points visible from Mount Washington, by W. H. Pickering. Application of Photography to Mountain Surveys, by J. B. Henck, Jr. The Flowering Plants of the White Mountains, by J. H. Huntington.

THE GEOGRAPHICAL MAGAZINE. — April. The Arctic Sledge Journals (Map). Chile. The River Purûs in its Commercial and Geographical Relations to the Valley of the Madeira (with Map of Purûs and Madeira Rivers), by E. G. Ravenstein. Indian Marine Surveys.

[1] The articles enumerated under this head will be for the most part selected.